Registered at the G.P.O. for Transmission to Canada and Newfoundland by Magazine Post.

VOL. 22. Ser. A. Part 2.—pp. 49–112. FEBRUARY, 1934.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

Price 2s. net.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Executive Council.

Sir CHARLES J. HOWELL THOMAS, K.C.B., K.C.M.G., *Chairman*, United Kingdom.

Colonel GEORGE P. VANIER, D.S.O., M.C., Canada.

F. L. MCDOUGALL, C.M.G., Australia.

NEVILL L. WRIGHT, F.I.C., New Zealand.

G. W. KLERCK, South Africa.

J. M. ADAMS, F.R.C.Sc. (I), Irish Free State.

Sir BHUPENDRA NATH MITRA, K.C.S.I., K.C.I.E., C.B.E., India.

B. F. WRIGHT, Southern Rhodesia.

R. V. VERNON, C.B., Colonies, Protectorates and Mandated Territories.

Sir DAVID CHADWICK, C.S.I., C.I.E., *Secretary*.

Director.

Sir GUY A. K. MARSHALL, C.M.G., F.R.S.

Assistant Director and Editor.

Dr. S. A. NEAVE, O.B.E.

Assistant Director and Superintendent of Farnham House Laboratory.

Dr. W. R. THOMPSON, F.R.S.

Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office—41, Queen's Gate, London, S.W.7.

MOORE (E. S.) & SMITH (A. J.). **Pests and Diseases in Tobacco Seed-beds.**—*Fmg. S. Afr.* 1933 reprint no. 46, 4 pp., 4 figs. Pretoria, August 1933.

Brief notes are given on the bionomics of five insects that attack young tobacco plants in seed-beds in South Africa, *viz.*, a Collembolan, the moths, *Phthorimaea heliopa*, Lw., and *P. operculella*, Zell., the Criocerid, *Lema bilineata* (tobacco-slug) [*cf. R.A.E.*, A **9** 186] and an Aleurodid [? *Bemisia* sp.], which is apparently the vector of tobacco leaf-curl [*cf.* **20** 330]. Control measures advised include spraying with 6–8 per cent. tobacco extract (1 : 80) against the Collembola and (with the addition of 3–4 oz. soap to 4 gals. of the mixture) the Aleurodids, and regular spraying, at least once a week, with lead arsenate (3 oz. to 8 gals. water) against *Phthorimaea* spp. and *L. bilineata*. Since the breeding of the Collembola is favoured by moist conditions, infested beds should be watered less frequently and the hessian covers removed to get rid of any excess moisture.

LIZER Y TRELLES (C. A.), MARCHIONATTO (J. B.) & BLASCO (M. A.). **Informe sobre procedimientos para la destrucción de la langosta.** [A Report on Methods of Locust Destruction.]—*Bol. mens. Minist. Agric. Argent.* **33** no. 2 pp. 181–195. Buenos Aires, 1933.

This is a survey of the mechanical devices, flame-throwers and chemical measures available in Argentina for combating locusts [*Schistocerca paranensis*, Burm.]. Nearly 25,000 miles of metal barriers are said to be kept in stock by the Government. Very brief notes are given on natural enemies, of which the most important are *Phorbia cilicrura*, Rond., parasitising the eggs, and *Sarcophaga* spp. attacking the hoppers and adults.

BLANCHARD (E. E.). **Sinopsis de los principales parásitos animales que dañan los cultivos.**—*Bol. mens. Minist. Agric. Argent.* **33** no. 2 pp. 197–225. Buenos Aires, 1933.

Keys are given to the insect and other animal pests of crops and forest trees in Argentina, based partly on the injury caused, together with a chapter describing general control measures and giving formulae for insecticides.

LIZER Y TRELLES (C. A.) & LACORTE (C. G.). **Aceites insecticidas.** [Insecticide Oils.]—*Bol. mens. Minist. Agric. Argent.* **33** no. 2 pp. 245–255, 16 refs. Buenos Aires, 1933.

Most of the information given here is taken from a Californian survey of oil emulsions [*R.A.E.*, A **18** 585]. Tests were made in October and November in the islands of the Paranà delta, Argentina, with emulsions containing 8 parts by weight of a commercial oil (Shell Mex No. 10 or No. 6 or red oil), 0·125 of ammonium caseinate, and 3·5 of water. They were applied freely at 2 per cent. strength to orange trees with tender leaves infested with *Toxoptera aurantii*, Boy., and larvae of *Mesolecanium deltae*, Lizer, the temperature being 22–27°C. [71·6–80·6°F.]. The plants were not injured in any way, and all stages of *T. aurantii* were destroyed, but *M. deltae* was not affected.

(101) Wt. P2821/3567 1700 2/34 S.E.R. Ltd. Gp. 353. [A] A

KÖHLER (P.). **La polilla de las colmenas** (*Galleria mellonella* **L.**). [The Bee-hive Moth.]—*Bol. mens. Minist. Agric. Argent* **33** no. 2 pp. 258–277, 7 pls., 8 refs. Buenos Aires, 1933.

This is a review of information on the bionomics and control of *Galleria mellonella*, L., infesting bee-hives. In Argentina, there are three generations a year, the winter one lasting 8 months. In the first, second and third generations observed in the laboratory, the incubation periods averaged respectively 6, 6 and 19 days, the larval 34, 31 and 52 and the pupal 13, 19 and 187.

SAMSON (J. N.). **The Amount of residual Arsenic on leafy Vegetable Crops sprayed and dusted with Arsenical Insecticides.**—*Philipp. Agric.* **22** no. 5 pp. 356–371, 9 refs. Laguna, P.I., October 1933.

An account is given of investigations in the Philippines to determine the amount of arsenical residue remaining on various vegetables that had received 1, 2, 3 or 6 applications of a dust of lead arsenate and air-slaked lime (2 : 10) or of a spray of 3 lb. lead arsenate and 1 lb. quick lime in 100 U.S. gals. water. They were harvested at various periods (minimum 5 days) after the last treatment, and heads from representative samples were chopped small and their moisture content determined before drying for analysis, so that the residue in comparison with the weight of the fresh material could be estimated. The results are discussed and tabulated. Dusting was more costly than spraying because larger quantities of insecticide were necessary. The yield of cabbage and similar crucifers was increased by either treatment, but no difference was observed in such plants as lettuce or celery, which are less susceptible to insect attack. The residue was generally reduced by weathering, that left by the spray being usually greater than that left by the dust. The amount of arsenic per kg. of fresh material never exceeded the lowest fatal dose for man (1·5 grains arsenic trioxide).

MARTELLI (G.). **Primo contributo alla conoscenza di alcuni parassiti dell'orobanche della fava** (*Orobanche speciosa* **D.C.**) [A first Contribution to the Knowledge of some Insect Enemies of *O. speciosa* parasitising Beans.]—*Boll. Lab. Zool. Portici* **28** pp. 11–36, 14 figs. Portici, 10th November 1933.

In this further paper on the insect enemies of *Orobanche speciosa*, a parasite of broad beans (*Vicia faba*) in Italy [*R.A.E.*, A **21** 441], notes are given on the bionomics of *Phytomyza orobanchiae*, Kalt., *Siphonella sulcicollis* var. *lacteipennis*, Duda, *Phorbia* (*Chortophila*) sp., *Smicronix cyaneus*, Gyll., and the Psilid, *Megachetum* (*Chyliza*) *atriseta*, Mg. *P. orobanchiae* may prove of value if some practical means for encouraging it can be found. *S. sulcicollis* var. *lacteipennis* appears too late to be of any use. The other three are of about equal value, though less important than *P. orobanchiae*.

ROMEO (A.). **Contributo alla biologia fiorale dell'***Araujia sericifera* **Brot. (La pianta " catturatrice " d'insetti.)** [A Contribution to the Floral Biology of the Insect-catching Plant, *A. sericifera*.]—*Ann. Inst. sup. agr. Portici* (3) **6** pp. 78–97, 3 figs., 2 pls., 26 refs. Portici, 1933.

This paper describes the structure and biology of the flower of *Araujia sericifera*, an insect-trapping plant of which the extensive

cultivation in Italy is suggested as a possible aid against insect pests. A short survey is given of the literature on this and similar plants, with lists of the insects captured by the flowers and those able to escape from them, as observed near Naples.

ROMEO (A.). **Il " cimiciato "** [Attack by Plant Bugs.]—10 pp., 1 pl. **Contributo alla conoscenza del " cimiciato " del pistaccio (Nota preliminare).**—8 pp., 3 figs. Portici, Tip. Editrice " La Vesuviana," 1929. [Recd. December 1933.]

In the first article the author discusses the exact nature of the damage to the nuts of hazel [*Corylus avellana*] in Italy and Sicily by various Rhynchota [*R.A.E.*, A **16** 595 ; **20** 565], and in the second records that in August 1929 considerable injury was caused to those of pistachio [*Pistacia vera*] in north-eastern Sicily by the Coreid, *Gonocerus acuteangulatus*, Goeze, the Pentatomids, *Carpocoris pudicus*, Poda, and *Graphosoma lineatum*, L., and the Lygaeid, *Spilostethus* (*Lygaeus*) *pandurus*, Scop. They sucked the fruits, tender branches and leaves, being able to pierce the endocarp even after it had become completely lignified.

MONASTERO (S.). **Un nuovo parassito endofago della mosca delle olive trovato in Altavilla Milicia (Sicilia). (Fam. Braconidae Gen.** *Opius*). [A new Endoparasite of the Olive Fly from Altavilla Milicia.]—*Atti R. Accad. Palermo* (3) **16** no. 3 pp. 95–201, 2 figs., 5 refs. Palermo, 1931.

A description is given of the Braconid, *Opius siculus*, sp. n., which was reared from about 40 per cent. of the pupae of *Dacus oleae*, Gmel. (olive fly) collected in Sicily during January–February 1930.

BALACHOWSKY (A.). **Contribution à l'étude des aphides de France (2e note). I. Sur la présence en France de** *Capitophorus fragaefolii* **Ckll., aphide nouvellement introduit et nuisible au fraisier. II. Sur l'existence de nouveaux foyers d'***Aphis forbesi* **Weed.**—*Rev. Path. vég. Ent. agric.* **20** fasc. 8 pp. 256–267, 1 pl., 1 fig., 17 refs. Paris, 1933.

Pentatrichopus potentillae, Wlk. (*Capitophorus fragaefolii*, Ckll.), the distribution and synonymy of which are reviewed, is recorded for the first time from France, where it was found to be widely distributed on strawberry in 1933. The alate and apterous parthenogenetic forms are described, and the life-history in the United States and Britain is briefly discussed and compared with the results of preliminary observations in France. In the laboratory, wingless forms bred from material collected near Avignon appeared on 15th March, though they are not seen in the field until considerably later. In northern France, the Aphids rarely appear before June, becoming most abundant in July after the strawberry harvest. In the Mediterranean zone, the species could probably maintain itself out of doors all the year round, as in California. It is doubtful, however, whether this would be possible in northern and central France, except where strawberries are grown under glass, unless sexual forms that lay overwintering eggs occur. The wingless forms attach themselves to the lower surface of the leaves, generally along the veins, and to the young shoots, but without causing malformation. Infested shoots and leaves are

blackened and shrivelled, but sooty mould has not yet been observed to follow attack. Apart from direct injury, the results of which are sufficiently serious, *P. potentillae* is liable to transmit certain virus diseases [*cf. R.A.E.*, A **21** 665] and may be responsible for the prevalence in several parts of France of withering of strawberry plants probably due to a similar virus. Sprays of nicotine sulphate and soap or emulsions of vegetable oil [*cf.* **19** 519] are recommended for control.

Cerosipha (*Aphis*) *forbesi*, Weed, another Aphid specific to strawberry and recently introduced into France [**19** 585], was observed on plants examined in June 1933 at Versailles. It occurs in dense groups at the collar of the plant, almost on the roots, and along the leaf petioles, as well as on the lower surface of the leaves and on the young shoots. During June and July, both alate and apterous forms were present, the latter being much the more abundant. Little injury was caused, however, owing to many of the Aphids being parasitised by *Aphidius*. The overwintering eggs were laid during the first week in November both in the insectary and in the field. The same sprays are recommended as for *P. potentillae*.

GHESQUIÈRE (J.). **Sur *Diaspis visci* (Schr.) Löw et deux de ses parasites nouveaux pour la faune belge.**—*Bull. Ann. Soc. ent. Belg.* **73** no. 10 pp. 343–349, 18 refs. Brussels, 15th October 1933.

Diaspis visci, Schr. (*carueli*, Targ., *juniperi*, Bch.), the synonymy of which is discussed, is recorded for the first time from Belgium, on *Juniperus communis*. It is a widely distributed species, occurring on various conifers and less frequently on yew (*Taxus*); though it has been found on mistletoe (*Viscum*), this is apparently not a food-plant. Two Aphelinids, *Aphelinus* (*Aphytis*) *mytilaspidis*, LeB., and *Aspidiotiphagus severiniellus*, sp. n., were reared from this material, this being the first record of parasitism of *D. visci* in Europe.

MOORE (M. H.). **Some incidental Effects of Routine Scab-sprays, with special Reference to Apple Fruit Sawfly-control—a Sidelight on the Interpretation of Field Spraying Experiments.**—*Rep. E. Malling Res. Sta. 1932* pp. 90–98, 9 refs. East Malling, Kent, May 1933.

Materials applied for the control of apple scab in orchards in south-eastern England were observed to reduce infestation of the fruit by *Hoplocampa testudinea*, Klug. In 1930, trees sprayed once at the pink-bud stage with Bordeaux mixture (8 : 8 : 100) or lime-sulphur (1 : 30) against scab with the addition of lead arsenate (4 lb. to 100 gals.) for the control of Lepidopterous larvae, such as those of the winter moth [*Cheimatobia brumata*, L.], showed 50 per cent. less damage by the sawfly than those treated with the lead arsenate alone, probably owing to a deterrent effect on the adults. Two applications with lead arsenate after blossoming gave similar results, Bordeaux mixture (8 : 25 : 100) being more effective than lime-sulphur (1 : 100); the second application, 3 weeks after petal-fall, was probably too late to be of much value. The reduction in the amount of lime-sulphur appeared to decrease the efficiency of the spray. Three applications (one before, and two after, blossoming) of either fungicide with or without lead arsenate reduced infestation to not more than half that found on control trees. Neither lime-sulphur (1 : 150) nor colloidal

sulphur (4 lb. to 100 gals.) applied with " spray " gelatine (0·1 per cent.) twice after blossoming nor lead arsenate alone gave satisfactory results. The superiority of the combination of fungicide and arsenical over the arsenical alone was again shown in 1931, when a dust of sulphur and arsenate also proved effective. In 1932, a spray of 8 oz. nicotine and 8 lb. soft soap to 100 gals. applied before blossoming against Capsids probably accounted for the scarcity of sawfly on all trees despite a heavy crop. Dusting with sulphur as a fungicide appeared also to reduce the numbers of *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.), which caused serious damage on control trees.

The author points out that no change in the routine application of nicotine and soap for the control of *H. testudinea* [*cf. R.A.E.*, A **17** 255 ; **21** 557 ; etc.] is suggested, the observations being recorded merely to illustrate the supplementary advantages obtained through measures against scab.

von Butovitsch (V.) & Lehner (W.). **Bestimmungstabelle der wichtigsten in märkischen Kiefernwaldböden vorkommenden Insektenlarven.** [Key to the principal Insect Larvae occurring in the Soil in Pine Forests in Brandenburg.]—16 pp., 18 refs. Berlin, J. Springer, 1933. Price, paper, *M.*0.90.

This key to the genera, and in some cases the species, of Coleopterous and Dipterous larvae found in the soil in pine forests in Brandenburg is based on simple characters and partly on the injury caused.

Zirnits (J.). **Observations on *Operophthera brumata* L.** [*In Lettish.*] —*Lauksaimn. Mēnešr.* [*J. Agric.*] no. 3 pp. 104–113. Riga, 1933.

Observations on the flight period of *Cheimatobia* (*Operophthera*) *brumata*, L., were made in Latvia in 1929–32 [*cf. R.A.E.*, A **20** 660] by trapping the moths on adhesive bands. It lasted from 30th September to 9th November in 1931 and from 8th October to 10th November in 1932. The moths first appeared 9–13 days after the first considerable fall in temperature, and their numbers decreased from about 25th October. The larvae caused unusually severe injury to apple in 1932, 18 per cent. of trees throughout the country being totally and 63 per cent. partly defoliated.

Ozols (E.). **Pea Pests.** [*In Lettish.*]—*Lauksaimn. Mēnešr.* [*J. Agric.*] no. 3 pp. 130–137, 1 fig., 16 refs. Riga, 1933.

Of the 31 species of insects mentioned in this survey of the fauna of peas (*Pisum sativum*) in Latvia, only the following are serious pests : *Cydia* (*Laspeyresia*) *nigricana*, Steph., which is the most injurious ; *Sitona* (*Sitones*) *lineata*, L., and *S. crinita*, Hbst., about 30 per cent. of the hibernating adults of which were killed by frost in one instance ; *Acyrthosiphon onobrychis*, Boy. (*pisi*, Kalt.), which was especially harmful in 1926 but was reduced in numbers by cold weather in May 1927 ; and *Kakothrips pisivorus*, Westw. (*robustus*, Uzel), which is more or less harmful every year and caused serious damage in 1927.

After an outbreak in 1927, *C. nigricana* was negligible in 1930, but infested as many as 47–56 per cent. of the peas in 1931 and 62–75 per

cent. in 1932. In 1931, the injury was most severe in densely growing varieties. The maximum number of eggs laid by a single female was 364. The incubation and larval periods were respectively 8 and 17·5 days at 20°C. [68°F.] and 29 and 65 days at 11°C. [51·8°F.]. Pupation takes place in the soil at a depth of about an inch. There is only one generation a year. Late sowing reduces the injury, but a poor crop results. Dusting with calcium arsenate and lime (1 : 4) reduced the number of injured seeds by 15 per cent. Most of the larvae (60–70 per cent.) pupate under the stacks, and by burning in such places a ten-inch layer of the pea-straw, it was possible to destroy an average of 95 per cent. during hibernation.

HERTZ (M.). **Tutkimuksia tavallisesta männynneulaspistiäisestä (*Lophyrus pini* L.) ja sen metsätaloudellisesta merkityksestä.** [The common Pine Sawfly, *Diprion pini*, and its Importance in Forestry.]—*Commun. Inst. for. Fenn.*, **18** 6 reprint 53 pp., 9 figs., 2 pp. refs. Helsingfors, 1933. (With a Summary in German.)

Diprion (*Lophyrus*) *pini*, L., has rarely been a serious pest of pines in Finland, but outbreaks occurred in 1920 and again in 1929 [*R.A.E.*, A **20** 438]. The literature on the classification and bionomics of this sawfly is reviewed, and notes are given on the amount and distribution of injury observed in 1929. In the autumn of that year, cocoons containing hibernating larvae were abundant on the ground under pine trees. The larvae pupated in spring, the males usually a little earlier than the females. Adult emergence continued for several weeks, but most of the adults appeared in June ; 34 per cent. were males. Increased light accelerated emergence, which therefore chiefly occurred at the brightest period of the day. The females laid large numbers of eggs and were able to reproduce parthenogenetically. Larval feeding lasted about 2 months, ending in September–October. Only one generation occurred, though conditions in 1930 were very favourable to the production of a second. Adults found in autumn may have been survivors of the overwintered generation. The larvae in the cocoons could withstand very great differences in temperature, and the adults resisted exposure for 1 hour to −2°C. [28·4°F.] or for 24 hours to a temperature between −1°C. and 0°C. [30·2°–32°F.]

Figures show how the cocoon was opened by *D. pini* itself and by its various parasitic and predacious enemies. The exit-hole of a Tachinid differed according to whether the latter had pupated inside the sawfly cocoon or not. Examination of about 4,500 cocoons at various seasons showed that small rodents were the most important natural enemies. They had destroyed about 71 per cent. of those found under moss in June 1930, when tits had opened about 10 per cent. Of those collected in the winter, 13 per cent. produced parasites. The Ichneumonids were by far the most important of these, the commonest being *Microcryptus subguttatus*, Grav., and *M. basizonus*, Grav. ; *Exenterus adspersus*, Htg., *E. marginatorius*, F., and *Pimpla arctica*, Zett., were less numerous. Three examples of a hyperparasite, *Hemiteles areator*, Panz., were reared from *M. basizonus*. *M. subguttatus* appeared to be less sensitive to adverse weather than the host.

The direct injury done by *D. pini* was not of much importance. It was far more pronounced in pine stands on dry heath-land than in places with richer soil, and the older or unhealthy trees were most

heavily infested. If necessary, the trees may be dusted with an arsenical. Trees weakened by loss of needles may have to be felled to prevent the establishment of dangerous secondary pests such as bark-beetles.

[Tziopkalo (V.).] **Циопкало (В.). On the Question of the Chemical Method of Control of the Pine Noctuid (*Panolis flammea* Schiff.).** [*In Russian.*]—*Sotzial. lesn. Khoz. Agrolesomel.* [*Social. For. & Agrosilvimelior.*] no. 3 pp. 64–67, 2 figs., 1 graph, 2 refs. Kharkov, 1933.

An account is given of laboratory tests of dusts for the control of *Panolis flammea*, Schiff., in western Ukraine, where a severe outbreak occurred in 1931 over an area of nearly 40 sq. miles of pine forest They were applied, at a rate approximately equivalent to 5 lb. per acre, to larvae on pine branches and also (to test their contact action) to larvae exposed in Petri dishes and subsequently transferred to untreated pine branches. The best results were obtained with "Forestit" [*R.A.E.*, A **20** 314, etc.], which killed an average of 80·8 per cent. of all instars on branches in 2·6 days, and in Petri dishes 100 per cent. of the first three instars in 10–35 minutes and 83·1 per cent. of all instars in 0·89 days. The percentages of all instars killed on branches and in dishes by calcium arsenite were 80·6 and 70·4 respectively in a little over 2 days, as compared with 69·9 and 58·2 by sodium fluosilicate in approximately the same period. Sodium fluoride and barium fluosilicate killed less than 50 per cent. As the first three instars were usually less resistant, dusting should be completed within 15–18 days after the larvae have hatched. Moreover, since the dusts have a contact action, it is not advisable to stop dusting when the larvae suspend feeding to moult, or to postpone it until they have ceased to penetrate into the pine needles for feeding. When the dosage was doubled, the effectiveness of coarse-grained dusts was noticeably increased, but that of fine ones only slightly so. In tests of the effect of the dusts on foliage, the percentages of the pine needles scorched were 11·8 by Forestit, 37·1 by sodium fluosilicate, 38·2 by calcium arsenite, and 62·5 by sodium arsenite. In further tests, an increase in the quantity of calcium arsenite, which is widely used in Russia for the control of forest pests, resulted in a corresponding increase in injury to the needles, 100 per cent. being scorched by an application at the rate of 20 lb. per acre. The presence in the dust of particles more than 0·074 mm. in diameter increased foliage injury and reduced toxicity.

[Alekseev (R.).] **Алексеев (Р.). An Experiment to determine the Standards of Fineness of Calcium Arsenite used in Dusting Forests from Aeroplanes.** [*In Russian.*]—*Sotzial. lesn. Khoz. Agrolesomel.* [*Social. For. & Agrosilvimelior.*] no. 3 pp. 68–74, 4 graphs, 5 refs. Kharkov, 1933.

In field experiments in May–June 1931 and June 1932, when a calcium arsenite dust containing 70·2 per cent. As_2O_3 was being applied from an aeroplane against larvae of *Panolis flammea*, Schiff., in pine forests in the Ukraine, the distribution of the dust was found by comparing the amounts settling on water in dishes placed at intervals on the soil or suspended in the crowns of the trees. Daily counts

were made over a period of 10 days of dead larvae fallen from the trees on to cleared soil below and of living ones on sample branches. The conclusions drawn are as follows : As much as 75 per cent. of the insecticide may be lost by dispersal in the air, owing to the presence of particles measuring less than 0·053 mm. in diameter, and 20 per cent. by falling to the ground, owing to the presence of particles more than 0·074 mm. in diameter. The maximum quantity that settled in the crowns of the trees was 14 per cent. of the dust released ; at least 66 per cent. of this amount, however, had no toxic effect on the larvae owing to the particles being too large. The larvae are killed chiefly by fine particles measuring less than 0·061 mm. in diameter. The dust used should therefore consist chiefly of particles from 0·053 to 0·061 mm. in diameter.

[Rekach (V. N.) & Dobretzova (T. A.).] **Рекач (В. Н.) и Добрецова (Т. А.). Cotton Aphids in Transcaucasia. Studies on Biology and Control.** [*In Russian.*]—*Trud. Zakavk. nauch.-issled. khlopk. Inst.* [*Trans. Transcauc. Cotton sci. Res. Inst.*] no. 34, 120 pp., 52 figs., 128 refs. Tiflis, 1933. Price 2 *rub.* (With a Summary in English.)

An account is given of the results of observations carried out in 1929–30 near Gandzha in Azerbaijan on the bionomics of Aphids, which are among the principal pests of cotton in Transcaucasia. The species concerned are *Doralis* (*Aphis*) *gossypii*, Glov. (of which three varieties are recognised), *D.* (*A.*) *flava*, Nevs., *D.* (*A.*) *laburni*, Kalt., *Myzus persicae*, Sulz., and *Trifidaphis phaseoli*, Pass., all of which are described from the literature. Their synonymy is briefly discussed, and it is suggested that *D. flava* [*R.A.E.*, A **17** 586] is only a form of *D. gossypii*. The numbers of Aphids increased from mid-May till July and then gradually decreased until September, when they began to rise again, the peak of infestation being reached in early November. In winter and the second half of summer, they are reduced to a minimum owing to unfavourable weather conditions. During June and July, infested cotton seedlings were deformed and stunted, and in autumn the cotton in the opened bolls was affected. The seasonal occurrence and relative abundance of the different species on cotton and other cultivated crops, as well as the parts of the plants on which they occur, are discussed. Their distribution is aided by wind, which carries wingless as well as winged forms for considerable distances, and to a less extent by water in the irrigation ditches, which carries fallen infested leaves.

D. gossypii was the only species of serious economic importance, being sometimes responsible for a loss of over 20 per cent. of the crop and causing the development of sooty mould [*cf.* **19** 160]. It overwintered on various weeds, on which the survivors bred in the spring, the first two generations being wingless and the winged forms appearing at the end of April. The bulk of these passed to cultivated crops as soon as they became available, concentrating chiefly on cotton. No sexuales or overwintering eggs were found. Large numbers of winged forms appeared in May and October. The Aphids matured in from 4 to 21 days and continued to reproduce for from 5 to 46, the average duration of life after this being 4·5 days. The total length of life averaged 33·9 days, with a maximum of about 3 months in winter ; winged Aphids lived up to 25 days. The wingless Aphids

produced an average of 42·6 larvae, with a maximum of 91, and the winged ones 15–28. In 1929, there were 20–22 generations from mid-April to 1st September. The optimum temperature for development is 16–22°C. [60·8–71·6°F.] ; temperatures above 25°C. [77°F.], excessive moisture, heavy rains and high winds are unfavourable. The food-plants in Transcaucasia include 10 cultivated plants and over 20 weeds ; next to cotton, cucurbits are preferred. Of natural enemies, several species of Coccinellids and Syrphid larvae are the most common and important ; an unidentified Hymenopterous parasite (? *Aphidius* sp.) was very active from about the end of April till July, and from the end of July a number of the Aphids were parasitised by *Aphelinus varipes*, Först.

Sprays of soap or tobacco extract are commonly used for control but are usually ineffective, the highest mortality obtained not exceeding 70–75 per cent., owing to the Aphids being sheltered in curled leaves. The use of dusts, as applied in the United States [**14** 490 ; **20** 648 ; etc.], and their advantages over sprays are discussed from the literature. In field experiments on a small scale, the best results were obtained with a 3 per cent. nicotine dust (7·5 parts nicotine sulphate and 92·5 parts slaked lime) ; used at the rate of about 25 lb. to the acre at 33·5°C. [92·3°F.] in the absence of wind, it killed on the average 94·5 per cent. and sometimes 100 per cent. Special attention should be devoted to clean cultivation, the destruction of weeds in winter, the removal of severely infested seedlings, and manuring, which, by promoting the growth of the plants, increases their resistance to attack. No immune variety of cotton was found, and early or late sowing had no effect on infestation [*cf.* **19** 241].

Notes are also given on the bionomics of *M. persicae*, *D. laburni* and *T. phaseoli*, all of which are of minor importance as pests of cotton. *M. persicae* developed chiefly on cruciferous weeds, cotton being only infested slightly and for a short period till about mid-July. No sexual forms or overwintering eggs were ever found, and peach was not attacked, this Aphid like *D. gossypii* being anholocyclic and only occurring on herbaceous plants. *D. laburni* was found on lucerne from the end of March to the end of November and in small numbers on *Robinia pseudacacia* [*cf.* **19** 445] in June ; infestation of cotton did not exceed 3·8 per cent. *T. phaseoli* was sometimes observed on the roots of cotton in early summer, but always disappeared in July.

EGUCHI (M.). **Biological Studies of** *Diatraea shariinensis* **Eguchi.** [*In Japanese.*]—*J. agric. Exp. Sta. Chosen* no. 19 pp. 1–20, 9 figs., 3 pls. Suigen, Korea, October 1933. (With a Summary in English.)

Diatraea shariinensis, sp. n., is numerous in the west and north of Korea, where the larvae cause severe damage to Italian millet (*Setaria italica*) by boring in the stalks. They are at first gregarious, but migrate to uninfested stalks when they grow larger. The eggs are deposited in clusters on the leaves and hatch in 11–12 days in June and 4–6 in July. The larvae of the first brood feed chiefly in June and early July, and those of the second in July and August. Most of the latter descend into the stubble for hibernation and pupate in May or early June. Moths of the first brood emerge in July and those of the second in August-September or from the end of May to the

middle of June of the following year. Normally there are two generations. Control measures recommended are digging and burning the stubble in autumn and removing infested stalks during June–August. The larvae are parasitised by *Chelonus munakatae*, Munakata, *Microbracon* (*Bracon*) *onukii*, Watanabe [*R.A.E.*, A **20** 606] and *Amyosoma* (*B.*) *chinensis*, Szép., which, however, are not sufficiently effective to check the rapid increase of the borer. Other grasses attacked include *Panicum miliaceum*, *Sorghum* and maize.

NAKAYAMA (S.) & TABASHI (I.). **Biological Studies of** *Anadastus fucosus* **Lewis.** [*In Japanese.*]—*J. agric. Exp. Sta. Chosen* no. 19 pp. 21–32, 1 pl., 10 refs. Suigen, Korea, October 1933. (With a Summary in English.)

The Languriid, *Anadastus fucosus*, Lewis, which was first observed in Korea in 1929, is abundant in Italian millet [*Setaria italica*] in the north and west, where 10–56 per cent. of the stalks are infested. The eggs are laid singly in the stalks and hatch in about 6 days in July. The larvae feed principally in the lower part during most of July and August, after which they hibernate in the stubble. The larval period occupies about 10 months and the pupal about 25 days, pupation occurring between mid-April and mid-June. The adult beetles are active during May–August, chiefly at night. Control is best obtained by digging up the stubble and burning it soon after harvest.

NAKAYAMA (S.), MASAKI (J.) & TABASHI (I.). **Notes on the Life History and Control Measures of** *Phaedon incertum*, **Baly.** [*In Japanese.*]—*J. agric. Exp. Sta. Chosen* no. 19 pp. 33–48, 2 graphs, 3 pls., 37 refs. Suigen, Korea, October 1933. (With a Summary in English.)

The Chrysomelid, *Phaedon incertus*, Baly, is present throughout Japan, Korea and Formosa, where the larvae (and to a less extent the adults) feed on a large number of food-plants, chiefly crucifers but including lettuce, carrot, beet and onion. In Korea 2–3 generations usually develop in the field, though 5 have been recorded in Japan, probably owing to the later occurrence of cold weather in autumn [but *cf. R.A.E.*, A **14** 642]. The adults hibernate from November to the latter part of March and are active for about 230 days in the year. They live for an average of 2–3 years, with a maximum of 4. Pairing occurs 3–4 and oviposition 13–14 days after emergence. The female lays an average of 550 eggs over a period of 170–180 days, chiefly on the lower surface of the leaves, the rate being less at high temperatures. The incubation period occupies 12 days at the end of April, 5 in mid-July, and 7 in late September. The larvae feed for about 2 weeks ; the young ones, which are sensitive to changes in temperature, attack only the lower surface of the foliage, but the older ones feed on the upper surface also. They pupate in the ground at a depth of about $\frac{1}{4}$ inch. It is difficult to estimate accurately the period over which damage is caused, but garden radishes infested for 6–7 weeks are very severely injured. A spray of about 1 fl. oz. derris soap to 1 gal. water is recommended. The adults are attacked by a fungus of the genus *Botrytis* and the larvae by a Phorid.

Fukushi (T.). **Transmission of the Virus through the Eggs of an Insect Vector.**—*Proc. imp. Acad.* **9** no. 8 pp. 457–460. Tokyo, October 1933.

An account is given of experiments in Japan indicating that the virus of dwarf disease of rice is retained from one generation to the next in its insect vector *Nephotettix bipunctatus* (*apicalis*) *cincticeps*, Uhl. [*cf. R.A.E.*, A **20** 275]. Pairs of leafhoppers, either one or both infective, were confined on young, healthy rice plants in glass tubes and transferred to new healthy plants daily. The eggs, which were laid in the leaf-sheaths near the ground, hatched in about 10 days [*cf.* **18** 555], and the nymphs were at once transferred to healthy rice plants (precautions being taken that they had no opportunity of feeding before transfer) and allowed to remain there for two months or more. The disease was transmitted by the majority of those derived from infective parents and by some of which only the female parent was infective, but the offspring of non-infective females and infective males were entirely free from virus. It is probable that a varying percentage of the eggs is affected by the virus at an early stage of their development in the ovary. This is the only virus disease of plants that has been proved to be transmissible through the eggs of the insect vector.

van der Vecht (J.). **De groote peperwants of semoenjoeng** (*Dasynus piperis* **China**). [The Large Pepper Bug.]—Proefschr. Rijksuniv. Leiden, vi + 101 pp., 19 figs., 15 refs. Leyden, 1933. (With a Summary in English.)

The Coreid, *Dasynus piperis*, China, all stages of which are described, occurs wherever pepper [*Piper nigrum*] is grown in the Netherlands Indies, but is a serious pest only in Banka, where the investigations here recorded showed its importance to be mainly due to the intensive agricultural methods practised. Since Rutger's report [*R.A.E.*, A **5** 442], the area under pepper in this island has increased. The bug is practically confined to pepper plantations. The nymphs are very active ; the adults are most active in bright sunshine. Both nymphs and adults feed only on the pepper fruits that are more than half ripe. On other parts of the plant, they could not be kept alive longer than a few days. Where a bug has inserted its rostrum, the starch gradually disappears and in time the contents become brownish black. Spikes on which even a few berries are attacked fall off after 6–8 weeks.

The egg-stage lasted 7–9 days and the nymphal 19–25, being shorter on older fruits. The largest number of eggs laid by one individual was 132, deposited during 45 days by a female that lived for 58 days, feeding on fruits 7 months old. Adult life lasted 25–85 days.

The direct effect of climate on the bug did not appear to be important, but there was an indirect effect through the food-plant, the presence of suitable fruits (4½–9 months old) depending on rainfall and agricultural methods. In old plantations, the fruits are harvested between June and September, and flowering occurs at the beginning of the wet season and lasts about two months during October–December. Thus few berries in a condition suitable for the bugs are available from September to March. In the young plantations, the flowers are plucked from time to time to accelerate growth, and the flowering period is thus prolonged. This is particularly

important in view of the fact that many young plantations, in which the bugs may find food in the off season, are laid out near old ones.

Spiders were occasionally found to attack the young bugs, but egg-parasites were the most important natural enemies. Of 1,300 eggs, nearly 80 per cent. were parasitised, and some of the remainder had evidently been collected immediately after deposition before a chance of parasitism could occur. The parasites were a Scelionid, *Hadronotus* sp., a Eupelmid, *Anastatus* sp., and *Ooencyrtus malayensis*, Ferrière [**19** 538]. Brief descriptions and notes on their distribution are given. *Hadronotus* developed in 14–17 days, and the adults, of which 22 per cent. were males, lived for an average of 26 days (maximum 54). *D. piperis* was the only host found. The development period of *Anastatus* was 16–18 days, and the average adult longevity 16 (maximum 23) for males and 32 (maximum 43) for females. In Banka, it also parasitised eggs of *Physomerus grossipes* var. *oedymerus*, Burm., *Nezara viridula*, L., and an unidentified Pentatomid, but attempts to rear it on those of *Leptocorisa acuta*, Thnb., were unsuccessful. *O. malayensis* required 12–13 days for development, the average adult life being 26 days (maximum 36) for males and 29 (maximum 48) for females. Of the adults, 21 per cent. were males. In Banka, it parasitised *D. piperis*, *P. grossipes* var. *oedymerus*, and an unidentified Pentatomid, and in Java, *Leptocorisa* sp., *Phaenacantha* (*Colobathristes*) *saccharicida*, Karsch, and *Homoeocerus marginellus*, H.-S. In the laboratory, it was also reared in the eggs of *Nezara* and *Plautia fimbriata*, F.

Evans (J. W.). **Thrips Investigation. I. The Seasonal Fluctuations in Numbers of *Thrips imaginis* Bagnall and associated Blossom Thrips.**—*J. Coun. sci. industr. Res. Aust.* **6** no. 3 pp. 145–159, 6 graphs, 3 refs. Melbourne, August 1933. [Recd. December 1933.]

The results are given of preliminary field observations carried out during the year ending March 1933 on the seasonal abundance of *Thrips imaginis*, Bagn. [*cf. R.A.E.*, A **20** 601] and associated species in the neighbourhood of Adelaide. Records of thrips population were made by means of an apparatus already described [**21** 625], sample counts being taken from roses throughout the year, and during the spring from the flowers of *Echium plantagineum*, *Cryptostemma calendulaceum* [*cf.* **22** 21] and a number of fruit trees, including apple. The incidence of *T. imaginis* in various months and the meteorological conditions during the observations are shown. The emergence of the first spring generation was spread over a long period, and owing to wet and cold weather in October, the development of the second was protracted. An appreciable increase became evident only with the appearance of the fourth generation at the beginning of December, when it was due more to overlapping waves of emergence, the result of high temperatures, than to actual multiplication following reproduction. There is no true resting stage, only a delayed development during the winter, the thrips appearing in the spring being the offspring of the second autumn generation. In the Adelaide district, where the winter is usually warm, oviposition and development may continue throughout the year. Unfertilised eggs of *T. imaginis* produce males only and fertilised eggs females only. This was the only species that was present in every sample of roses, though, as no

immature stages were found, roses are evidently not favourable breeding sites. Other species, which are enumerated, were much less abundant and do not play any appreciable part in outbreaks. The sex ratio of *T. imaginis* was not constant, the females predominating in May, June and July and especially in the spring, whereas in November the proportion of males increased, and from December till the end of March the sexes were approximately equal. On *Cryptostemma*, the thrips increased to a maximum at the middle of the flowering period. Increased temperatures shortened the life-cycle, but the correlation between them and the rise in the numbers of thrips becomes evident only after a succession of days of temperature above 25°C. [77°F.], when large numbers emerge and generations overlap Apple blossoms examined in October–November were very lightly infested, although the rainfall in the previous April–August had been unusually heavy and the spring was thus one in which an outbreak of thrips might have been expected [**20** 602]. The maximum numbers on *Echium* occurred about the end of November.

Four other species were commonly found associated with *T. imaginis* in blossom, all of them sometimes occurring in roses. Of these, *Isoneurothrips australis*, Bagn., concentrated in the summer on *Eucalyptus* blossoms, but during other seasons occurred on a wide range of plants ; its increase began earlier in spring and continued later in autumn than that of *T. imaginis*. *Frankliniella insularis*, Frankl., was abundant only during the summer, infesting a large variety of plants, of which carnations were preferred. *Haplothrips victoriensis*, Bagn., was present the whole year round, being numerous from December till the end of March. *T. tabaci*, Lind., was also most abundant and widely distributed during the summer, but had begun to breed on *Ageratum* before the end of October.

An appendix deals with a method of plotting development curves by which, on the basis of data already collected, the periods of generations of *T. imaginis* occurring in any season can be calculated. The threshold of development for the egg-stage is shown to be 6·6°C. [43·88°F.] and for the period from hatching to oviposition 9°C. [48·2°F.], and the thermal constant 55·2 and 112·5 day-degrees C. [103·05 and 202·5 F.] respectively.

Davidson (J.). **The "Lucerne Flea" Problem in South Australia.** —*J. Dep. Agric. S. Aust.* **37** no. 3 pp. 291–297, 3 figs. Adelaide, 16th October 1933.

An account is given of the bionomics and distribution of *Smynthurus viridis*, L., on clover and lucerne in South Australia [*R.A.E.*, A **21** 521, etc.], and it is suggested that investigations of its natural enemies and of the relation of mixed pastures of clover and grasses to infestation might prove profitable lines for further research.

Jarvis (H.). **Fruit Fly Control in the Stanthorpe District.**—*Qd agric. J.* **40** pt. 4 pp. 282–283 ; also as *Adv. Leafl. Dep. Agric. Stk Qd* no. 3, 2 pp. Brisbane, 1st October 1933.

In order to prevent increasingly serious injury in orchards in Queensland by the fruit-fly [*Dacus ferrugineus*, F.], the importance of trapping and disposal of waste fruit is emphasised. The traps should contain Harvey or Jarvis bait [*R.A.E.*, A **20** 155], and as many as possible should be used throughout the season, from mid-October onwards.

All waste and infested fruit should be deposited in a pit (6 × 5 ft and not less than 20 ft. deep), having a hardwood covering banked over with earth, in which is an opening (14 × 14 ins.) with a combing about 4 ins. high to which a lid is fitted.

SUMMERVILLE (W. A. T.). **Two Insect Enemies of Nut Grass.**—*Qd agric. J.* **40** pt. 4 pp. 284–287; also as *Pamphl. Dep. Agric. Stk Qd* no. 13, 6 pp. Brisbane, 1st October 1933.

Antonina australis, Green, which is found on the roots of nut-grass (*Cyperus rotundus*) in New South Wales, was introduced into Queensland in 1910 in the hope that it would control it there. Observations have shown, however, that it only affects the spread of the sedge in dry, loose soil unsuitable for agriculture. Coccids of the genus *Antonina* have been observed on various grasses and on dahlia roots, but it appears improbable that *A. australis* has alternative food-plants. The dominant and possibly the only species on nut-grass in northern Queensland is apparently *Kuwanina hilli*, Laing [*R.A.E.*, A **13** 420]. A mealybug frequently found on nut-grass is of no importance in its control.

ATHERTON (D. O.). **The Tomato "Green Fly" Association.**—*Qd agric. J.* **40** pt. 4 pp. 291–298, 2 refs.; also as *Pamphl. Dep. Agric. Stk Qd* no. 14, 10 pp., 2 refs Brisbane, 1st October 1933.

Tomatos in the Bowen district, Queensland, are attacked by a Jassid, *Empoasca* sp., and the Capsid, *Engytatus* (*Cyrtopeltis*) *tenuis*, Reut., which almost always occur together, the former being more numerous. Observations in 1931 showed that the loss in vitality of the plant and the severe injury to the central foliage are due entirely to the Jassid, whereas "blossom-drop" may possibly be partly due to the Capsid. The latter was rare until the end of September and during October, when it became numerous throughout the district. It apparently feeds only on the fruit and the young growing shoots; the adults attacked those of the Jassid in confinement, but no predatory habits have been observed in the field. Gravid females contained 6–8 eggs.

Empoasca is present practically throughout the State. It removes the sap from the laminae of tomato leaves, especially the central ones, and in severe cases destroys most of the chlorophyll, causing unhealthy and distorted development, which may result in the death of the plant. The fruit may require wiping with a damp cloth to remove excreta. Breeding was continuous from April to October, when investigations were stopped, and the maximum numbers were present in late July and in August, during a period of seasonal abundance of the crop. The eggs were usually laid in the petioles or veins of the leaves, but occasionally in the growing stems. The immature stages are briefly described. The incubation and nymphal periods occupied 10–14 and 10–27 days respectively. The females had a pre-oviposition period of 11–16 days and appeared to mature 4–6 eggs at a time. In the laboratory, one laid eggs at intervals for over 3 weeks, and several adults lived for a month and one for 6 weeks. One variety of tomato was found to be more attractive, the leafhoppers sometimes migrating to it from others. Plants from which all stages of *Empoasca*

have been obtained include beet, carrot, french beans, peas, tobacco, potato and egg-plant (*Solanum melongena*); those from which adults have been collected include cabbage, lettuce, ground-nuts (*Arachis hypogaea*), *Sorghum* and maize. The eggs were attacked by the Mymarid, *Anagrus armatus* var. *australiensis*, Gir., which was rare, and by the Trichogrammatid, *Aphelinoidea howardi*, Gir., which parasitised 30 per cent. of one lot of material, though it does not appear to exercise any control in the field.

Tomatos planted late in the season and irrigated regularly make luxuriant and prolific growth and appear capable of supporting considerable infestation of the Jassid without evident deterioration for a number of weeks after the beginning of harvest. Burgundy mixture (4 : 5½ : 40) did not control *Empoasca*, and appeared to have a deleterious effect on the foliage and fruit; trials with dusts gave inconclusive results.

Risbec (J.). **Un ennemi du *Brontispa froggatti* Sharp aux Nouvelles-Hébrides.**—*C. R. Acad. Sci. Fr.* **197** no. 22 pp. 1357–1358. Paris, 1933.

Both adults and larvae of *Brontispa froggatti*, Sharp, an important pest of coconut, live among the unexpanded leaves of the palms [*R.A.E.*, A **17** 416], feeding on the parenchyma. Trees that are heavily infested, as sometimes is the case in New Caledonia [*cf.* **18** 510], may die. In the New Hebrides, little harm is done to old palms, but those under 5 years old may be seriously damaged. Believing that the apparent check on infestation observed on some trees there might be due to the presence of *Chelisoches morio*, F., the author confined individuals of this earwig and of the Hispid together. The earwigs ignored the adult beetles, but readily devoured the larvae. It is suggested that natural control by this predator might be assisted by partly unfurling the leaves containing the Hispid larvae.

Lever (R. J. A. W.). **The Coconut Leaf-beetle of the Santa Cruz Group.**—*Brit. Solomon Is. agric. Gaz.* **1** no. 4 pp. 11, 8, 2 figs. Tulagi, October 1933.

All stages of a Hispid, allied to or possibly identical with *Promecotheca opacicollis*, Gestro, which is a pest of coconut in the New Hebrides [*R.A.E.*, A **12** 299], were found on the leaves of young coconut palms in two islands of the Santa Cruz Group in May and June 1933. Batches of 3–5 eggs are laid on the lower surface of the leaves and protected by small mounds of material cut from the leaf tissue by the adults. The eggs are parasitised by a Trichogrammatid, which aids in the control, and a Chalcid, which is less common. The larvae mine within the fronds of the open leaves, causing blister-like streaks up to 6 ins. long. On heavily infested trees, the withering of the leaves results in an appreciable loss of surface. It is most injurious in areas of low rainfall and would not compete in the Solomon Islands with *Brontispa froggatti*, Sharp, the larvae of which occur between the fronds of the unopened leaf [**17** 416]. It is potentially a serious pest in consequence, and it would be desirable to confine it to its present area by forbidding the introduction of palm leaves from the Santa Cruz Islands, throughout which it is probably distributed.

Lever (R. J. A. W.). **Insects of the Coconut Palm in the British Solomon Islands. List 2.**—*Brit. Solomon Is. agric. Gaz.* **1** no. 4 pp. 15–16. Tulagi, October 1933.

Species recorded, in addition to various Hymenoptera of possible service in cross-pollination, are *Pseudococcus cocotis*, Mask., which is found on female flowers but is not known to be a pest, and the Tenebrionids, *Pediris* (*Setenis*) *sulcigera*, Boisd., which breeds in rotten coconut trunks, and *Amarygmus hydrophiloides*, Fairm., which occurs in crevices in the so-called bark and in decaying logs. *Anoplolepis* (*Plagiolepis*) *longipes*, Jerd. (which is a less efficient predator on *Axiagastus* [*cambelli*, Dist.] than *Oecophylla* [*smaragdina*, F.]) and *Pheidole oceanica*, Mayr, construct galleries up the trunks, and *Iridomyrmex myrmecodiae*, Emery, occurs in the crowns of coconuts, in galls on *Myrmecodia* and on healthy *Areca* in the jungle. Both *Pheidole* and *Iridomyrmex* interfere with the control of *Axiagastus* by *Oecophylla* [**21** 207].

Pemberton (C. E.). **Delayed Incubation Period among Eggs of *Oxya chinensis* (Thun.) (Orthoptera).**—*Proc. Hawaii. ent. Soc.* **8** no. 2 pp. 251–252, 1 ref. Honolulu, November 1933.

In the course of investigations on the egg parasites of *Oxya chinensis*, Thnb., during 1930–31 [see next paper], occasional instances were observed in which the incubation period of the eggs of the Acridid was prolonged, under constant conditions of moisture and at normal temperatures, for more than the usual 6 weeks [*R.A.E.*, A **15** 322]. The longest period observed in Malaya was 151 days (October to March) and in Hawaii 277 days (September to June).

Pemberton (C. E.). **Introduction to Hawaii of Malayan Parasites (Scelionidae) of the Chinese Grasshopper *Oxya chinensis* (Thun.) with Life History Notes.**—*Proc. Hawaii. ent. Soc.* **8** no. 2 pp. 253–264, 2 pls., 10 refs. Honolulu, November 1933.

An account is given of the biology of *Scelio pembertoni*, Timb., which has been introduced from Malaya into Hawaii for the control of *Oxya chinensis*, Thnb. [*R.A.E.*, A **21** 347, 493]. The process of oviposition, which occurs daily for 8–14 days in eggs of any age, and the appearance of the egg and the newly hatched larva are described. Unfertilised females produced males. The length of the egg-stage was not accurately determined, but host eggs contained first-instar larvae after 5 days. The life-cycle in Malaya varied considerably according to the month ; emergence from a parasitised egg-pod began within 25–38 days and continued a further 10–25.

Chapman (R. N.). **The Causes of Fluctuations of Populations of Insects.**—*Proc. Hawaii. ent. Soc.* **8** no. 2 pp. 279–297, 5 graphs, 13 refs. Honolulu, November 1933.

The author discusses at some length, with reference to the literature, the problem of the fluctuations of insect populations and describes the progress of experiments with *Tribolium confusum*, Duv. [*R.A.E.*, A **16** 312, 516 ; **21** 193] to test the validity of the concepts of biotic potential and environmental resistance [**15** 547 ; *cf.* **21** 652]. In one of these experiments, remarkable rhythmic fluctuations observed were

found to be due to the presence of a Sporozoan parasite, *Adelina* sp., which killed the larvae about the time of pupation.

The following is taken from the author's summary of the results hitherto obtained : Under constant environmental conditions, populations rise to a saturation point, independently of the size of the environment and of the initial population ; those of which some members feed on others fluctuate periodically. These findings support the deductions of Volterra [*cf.* **20** 254]. If a population is started from individuals with a reproductive potential below the average for their species, it will ultimately, though more slowly, reach its normal saturation point, because this abnormality, like any individual advantage or disadvantage that is not inherited, will be lost in the next generation.

Wright (J. B.). **Notas sobre el contralor de la mosca de la fruta.** —*Publ. mens. Direcc. Agron. Uruguay* **6** no. 3–7 pp. 51–53. Montevideo, 1933.

Reference is made to the discovery by M. Kisliuk jr. and C. E. Cooley of *Ceratitis capitata*, Wied., and *Anastrepha* sp. in the fruit-growing districts of Uruguay. The occurrence there of suitable fruits permits of reproduction throughout the year, but the flies are very scarce in winter owing to the cold. Control measures used against fruit-flies in the United States and in Mexico are briefly surveyed.

Wolcott (G. N.). **An Economic Entomology of the West Indies.**— Cr. 8vo, xviii + 688 pp., 111 figs., 174 refs. San Juan, P.R., Ent. Soc. Puerto Rico, 1933. Price $2.00.

This is the first comprehensive work to deal with the insect pests of the West Indian Islands as a whole and has been much needed for many years. The first section contains general notes on the structure, development and classification of insects and the materials used in their control. The following ones comprise comprehensive accounts of the bionomics, natural enemies and control of the insect pests of economic grasses, fibre crops, trees (coffee, cacao and coconut), fruits and garden crops (including tobacco) in the West Indies, and are subdivided into chapters dealing separately with the more important plants or trees. In the case of sugar-cane, which is the most important crop, particular reference is made to the part of the plant attacked, to the various types of insects concerned and also to the special problems existing in Trinidad, where the flora and fauna resemble those of South America rather than of the other islands. The Coccids attacking *Citrus* and their control are also discussed in rather more detail owing to their abundance and the severity of infestation.

The book is well produced, and it contains many original illustrations and an adequate index.

Box (H. E.). **An Early Reference to Sugar-cane Entomology in the British West Indies.**—*West India Comm. Circ.* 26th October 1933, reprint 1 p. London, 1933.

The author quotes the original Latin, together with a translation, of a paper containing an early reference (1734) by C. Hamilton to a sugar-cane pest in Nevis and Antigua, which has been supposed

to be *Diatraea saccharalis*, F. From the description, however, especially the statement that the offspring were produced in the form of a mass resembling pus, it was probably a Cercopid. This is interesting in view of the fact that no froghoppers are now known as sugar-cane pests in Nevis and Antigua, though *Tomaspis saccharina*, Dist., occurs as far north as Grenada. The account may, however, conceivably refer to *Stenocranus* (*Saccharosydne*) *saccharivorus*, Westw. (cane fly), although the eggs of this Delphacid are laid in slits on the leaves, and the white waxy powder that covers the eggs and exudes from the immature stages does not resemble the substance surrounding the eggs and nymphs of Cercopids.

Edwards (W. H.). **Report of the Government Entomologist.**—*Rep. Dep. Agric. Jamaica 1932* pp. 16–18. Kingston, Jamaica, 1933.

The only notable pest of sugar-cane in Jamaica in 1932 was *Eutermes ripperti*, Ramb., which attacked ratoons as well as newly planted cuttings. Rotting stumps of coconut and other trees harboured large colonies of this termite. Smearing newly planted banana suckers with a mixture of coal tar and kerosene to repel *Cosmopolites sordidus*, Germ., proved ineffective, except when quantities were applied that seriously injured the plants. *Eretmocerus serius*, Silv., introduced from Cuba for the control of *Aleurocanthus woglumi*, Ashby, on *Citrus* [*R.A.E.*, A **20** 512], was successfully established in two localities by the end of September, and hundreds of adults were then liberated in *Citrus* nurseries. Owing to low rainfall, coconut was heavily infested in some districts with *Aspidiotus palmae*, Morg. & Ckll., which was, however, well controlled by the Coccinellid, *Exochomus ritchiei*, Sic. In one estate, coconut was attacked by *Xyleborus perforans*, Woll.

Pests of vegetables reported during the year were: *Heliothis obsoleta*, F., and the Pentatomid, *Loxa flavicollis*, Drury, on tomato and egg-plant [*Solanum melongena*]; the Coreid, *Corecoris fuscus*, Thnb., on sweet potato [*Ipomoea batatas*]; *Doralis* (*Aphis*) *gossypii*, Glov., and *Diaphania hyalinata*, L., on melon; and *Pieris* (*Pontia*) *monuste*, L., and *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) on cabbage. Control of the Halticid, *Disonycha laevigata*, Jac., on beet was rendered difficult by the existence of an alternative food-plant, *Alternanthera ficoidea*. Newly planted lettuce and other vegetables were often severely attacked by garden millepedes, outbreaks of which are attributed to the constant humidity of the soil caused by uninterrupted irrigation and also to the practice of leaving heaps of rotting vegetable matter beside the beds. *Gryllus assimilis*, F., in gardens and *Citrus* nurseries was controlled by soil fumigation with calcium cyanide. Damage to seedlings and young plants by the cutworms, *Prodenia ornithogalli*, Gn., *Lycophotia infecta*, Ochs., and *Xylomyges sunia*, Gn., was reduced by the use of poison-baits and sprays.

A preliminary investigation suggested that mosaic disease of papaya is not transmitted by the Aphids and Aleurodids commonly found on the plants.

Knowlton (G. F.). **Ladybird Beetles as Predators of the Potato Psyllid.**—*Canad. Ent.* **65** no. 11 pp. 241–243. Orillia, November 1933.

Adults (and in most cases nymphs also) of *Paratrioza cockerelli*, Sulč, were attacked in the laboratory in the spring of 1933 by the

larvae and adults of *Hippodamia convergens*, Guér., and the adults of *H. americana*, Crotch, *H. lecontei* var. *uteana*, Csy., *H. quinquesignata*, Kby., and *H. tredecimpunctata*, L. These Coccinellids probably aid in the control of the Psyllid in Utah, as the larvae and adults are reasonably abundant wherever potatoes are grown.

COMPERE (H.). **The Parasites of *Pseudococcus comstocki* Kuw.**—*Canad. Ent.* **65** no. 11 pp. 243–247. Orillia, November 1933.

Pseudococcus comstocki, Kuw., attacks a variety of plants in the eastern United States [*R.A.E.*, A **13** 567 ; **19** 531 ; etc.] and might become a dangerous pest in California [**7** 743]. Observations are reported on its natural enemies in China, where it is a pest of *Citrus* [*cf.* **18** 320]. *Diplosis* sp. was the most abundant, and *Anagyrus subalbipes*, Ishii, in great numbers, and *Coccophagus pseudococci*, sp. n. (both sexes of which are described) occasionally, emerged from material from one orchard. Both *Diplosis* and *Anagyrus* reproduced readily on mealybugs reared on potato sprouts. As the latter was described from *Pseudococcus* sp. in Japan [*R.A.E.*, A **18** 258], this observation supports the theory that the mealybug commonly found on *Citrus* in that country is *P. comstocki*. Larvae and adults of *Scymnus bipunctatus*, Kug., were also observed.

The female of *Tropidophryne flandersi*, sp. n., is described from *Pseudococcus* sp. on *Acacia longifolia* in New South Wales, and it is believed that the host may have been *P. comstocki*.

WALLEY (G. S.). **New and little known Canadian parasitic Hymenoptera (Ichneumonoidea).**—*Canad. Ent.* **65** no. 11 pp. 253–261. Orillia, November 1933.

The species dealt with include the Braconid, *Macrocentrus cuniculus*, sp. n., the female of which is described from the gallery of a moth, (?) *Rhyacionia* (*Evetria*) sp., in Jack pine [*Pinus banksiana*] in New Brunswick, and the Ichneumonids, *Exenterus canadensis*, Prov., and *E. diprioni*, Roh. (of which the author considers *E. affinis*, Roh. [*R.A.E.*, A **8** 381] to be a synonym), bred from *Diprion* (*Neodiprion*) spp. in various parts of Canada. A key to the North American species of *Exenterus* is given.

CHAMBERS (E. L.) & THOMPSON (N. F.). **Some of the more Important Insects and Plant Diseases of Wisconsin Trees and Shrubs.**—*Wisconsin Dep. Agric. Bull.* no. 123 (*i.e.* 124), 58 pp., 24 figs. Madison, Wis., August 1931.

CHAMBERS (E. L.) & THOMPSON (N. F.). **Pests and Diseases of Trees and Shrubs.**—*Wisconsin Dep. Agric. Bull.* no. 145, 87 pp., 50 figs. Madison, Wis., May 1933. [Both recd. December 1933.]

These bulletins, which are intended primarily for nurserymen, include notes on the bionomics and control of the more important insect pests of shade and fruit trees, shrubs and some garden plants such as gladiolus in Wisconsin, arranged under the plants attacked. The second, which is an enlargement of the first, deals with a larger number of pests and has a section containing general information on control measures.

KNOWLTON (G. F.). [**Insect Pests in Utah.**]—*Leafl. Utah agric. Exp. Sta.* nos. 1–6, illus. Logan, Utah, November 1933.

These leaflets give brief notes on the bionomics and control of various insects injurious in Utah. The first deals with *Loxostege sticticalis*, L. (sugar-beet webworm), which caused serious damage to sugar-beet in 1932 and 1933 and to lucerne in 1932. The larvae may destroy practically all the foliage, reducing the yield of the plants or killing them. They hibernate in silken cocoons and pupate in spring, the adults emerging in June. Under favourable conditions, the females lay 100–700 eggs each. These hatch in 3–5 days, and the larval stage lasts 2½–3 weeks. The second generation begins late in July, and there appears to be a small third one, which seldom causes injury. Paris green (4 lb. to the acre) should be applied in a spray as soon as injury is observed.

The second leaflet contains information on *Anasa tristis*, DeG. (squash bug), the nymphs and adults of which attack squash and pumpkins, killing the small plants and severely affecting the runners of larger ones. Occasionally they also infest water-melons and young beans. The winter is passed in the adult stage, pairing and oviposition occurring in the spring. The eggs hatch in 6–15 days, and the nymphs mature in 4–6 weeks. Treatment with calcium cyanide dust [*cf. R.A.E.*, A **16** 80] has to be repeated, as 20–40 per cent. of the adults recover. A spray of 40 per cent. nicotine sulphate (1 : 400) or of 8 oz. nicotine sulphate and 4 lb. soft soap in 25 U.S. gals. water will give good control of nymphs that are covered with the liquid. Hand-picking is commonly practised and may be facilitated by using as traps small boards under which the bugs may shelter. Clean cultivation is important.

The third leaflet deals with *Leptocoris trivittatus*, Say (box-elder bug), which causes annoyance in houses and may puncture various fruits, decreasing their market value [*cf.* **21** 453]. The normal food-plants are box-elder [*Acer negundo*] and other maples. Eggs are laid in the spring by overwintered females, the adults of the new generation appearing during mid-summer and autumn. There is apparently a partial second generation in Utah. The bugs are best controlled when they are congregated round their hibernating quarters in late autumn or early spring ; kerosene will kill the nymphs on tree trunks, but a commercial fly spray is probably most convenient for use in houses.

In the fourth leaflet, it is stated that *Erythroneura comes* var. *ziczac*, Walsh, and var. *elegans*, McAtee, are the most serious pests of Virginia creeper [*Parthenocissus quinquefolia*], causing complete defoliation by the end of August in severe cases. On leaving their winter quarters among leaves and rubbish, the adult Jassids feed on various plants till the foliage of grape vines or Virginia creeper is available. The eggs are laid after 2–3 weeks and hatch in about 2 weeks. The nymphs develop in 18–28 days. The hibernating leafhoppers may be destroyed by burning the leaves or cultivating the soil in autumn. The plants may be treated before serious damage has been caused with a spray containing nicotine sulphate [**21** 589] or pyrethrum at 150–200 lb. pressure. Calcium cyanide, preferably a coarse type, is effective against all stages and is probably the best material for use in mid-summer. Where convenient, the dust may be applied to vines under a canvas or cotton covering.

The fifth leaflet emphasises the importance of destroying the eggs of grasshoppers late in the autumn by the use of a disk or a harrow [*cf.* **21** 649], the depth at which they are concealed in the ground having first been ascertained.

The sixth leaflet records the recent spread of *Leptinotarsa decemlineata*, Say, into Utah, where it is at present confined to a small area. The overwintered adults deposit 500 or more eggs on the lower surface of the potato leaves, chiefly during the last half of May and the first of June. Adults of the first generation are present from early July and those of the second from August, entering hibernation during October. The usual control measures are recommended [**19** 475 ; etc.].

White (W. H.) & Brannon (L. W.). **The Harlequin Bug and its Control.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1712, 9 pp., 6 figs. Washington, D.C., August 1933. [Recd. December 1933.]

This bulletin is a revision of one previously noticed [*R.A.E.*, A **8** 249]. Since 1920, *Murgantia histrionica*, Hahn (harlequin bug) has spread from the southern to many of the northern United States, but it is an important pest only in the southern States. In exceptionally mild winters, all stages have been found in the field in February as far north as Virginia. Further south, hibernation (under débris in or near infested fields) is usually not continuous, the bugs becoming active on warm days. The eggs are laid (about 15 days after the adults become active in spring) in double rows of 10–13 on the lower surface of the leaves of crucifers. Other plants occasionally attacked include cucurbits, maize and beans. One female may lay an egg-mass every 5–6 days, and a maximum total of 187 eggs, the average being 115. In cool weather the eggs hatch in 15–20 days, and in warmer weather in 4–5. The nymphs remain near the egg shells for 24–36 hours before beginning to feed. The life-cycle from egg to adult takes 60–70 days in early spring and 40–60 in summer. The pre-oviposition period is 2–3 weeks. Some of the overwintered adults live 120 days, but the average life is 60 days. The oviposition period is also longest (40–80 days) in this generation. Usually there are two generations and a partial third annually.

The eggs are parasitised by *Ooencyrtus johnsoni*, How., and the Scelionids, *Trissolcus murgantiae*, Ashm., and *T. podisi*, Ashm. The Encyrtid was first recorded in Virginia in 1931 and was of considerable value in the severe outbreak of the bug there in 1932, infesting 50 per cent. of the eggs collected from the field in late August. As many as three parasites sometimes develop in one host egg. The Reduviid, *Arilus cristatus*, L. (wheel bug) has been recorded as feeding on nymphs of *M. histrionica*, and the Coreid, *Leptoglossus phyllopus*, L., on adults.

Hand-collection in spring is often of value in control, as the adult bugs are conspicuous and sluggish and tend to congregate in small patches in a field. Heavily infested plants should be destroyed. Trap-crops may be planted in early spring and autumn, on which the bugs may be easily killed with a kerosene torch or a plumber's blow-lamp. The best results in spraying were obtained with 2 qts. derris extract containing a spreader in 100 gals. water. Some of the spray should be directed to the base of the plants to cover any bugs that may have been knocked off by the spray rod. Commercial dusts containing 0·5 per cent. rotenone were also effective in preliminary tests.

Insect Pests and related Matters.—*45th Rep. S. Carolina Exp. Sta. 1931–32* pp. 65–79, 3 figs. Clemson Coll., S.C., December 1932. [Recd. December 1933.]

O. L. Cartwright reports that the species of *Diatraea* recorded from *Paspalum scrobiculatum* [*R.A.E.*, A **20** 355] was *D. evanescens*, Dyar, and not *D. crambidoides*, Grote. In a survey in November 1931, the latter species was found in maize throughout the State ; the percentage of injured stalks averaged 51·64, and that infested with hibernating borers 32·46. Each 1 per cent. infestation was accompanied by a loss of about 0·3 per cent. in weight of crop. Two generations of *Sphenophorus* (*Calendra*) *callosus*, Ol., were reared in the laboratory by 15th August from adults that left hibernation on 27th April or later, but in the field the pupae of the first generation were not found until 19th July. The weevils fed on grasses and maize, and eggs were laid on various grasses, including *Eleusine indica* and (in the laboratory) *Sorghum*. In experiments against the corn earworm [*Heliothis obsoleta*, F.] in view of the damage caused to sweet maize in gardens, 1–3 applications of lead arsenate dust gave 60–80 per cent. control in the field, 87·6 per cent. of the ears on untreated plants being damaged. More adults of the cotton boll weevil [*Anthonomus grandis*, Boh.] emerged from hibernation in cages placed in a sheltered ravine than in those in an exposed situation on a hill, and oak leaves and pine needles gave better protection in the cages than maize stalks. An average of 11·6 per cent. of all the weevils placed in the cages in October 1931 emerged.

It is stated by J. G. Watts that, though sprays of nicotine and pyrethrum show promise against thrips on seedling cotton, the application is so costly that control is best obtained by cultural methods. The crop should be planted as far from small grains as possible, all green vegetation having been turned in about 2 weeks previously, and vigorous growth should be maintained. Early and frequent cultivation will accelerate growth and destroy a certain number of the thrips, particularly the pupae. *Frankliniella fusca*, Hinds, *Thrips tabaci*, Lind., and *F. tritici*, Fitch, are the most important species ; they completed their life-cycles in 18·5, 15·01 and 16·3 days respectively under identical conditions.

According to W. C. Nettles, *Cydia* (*Laspeyresia*) *molesta*, Busck, was more injurious in 1932 than during the two previous years [*cf.* **20** 633]. *Trichogramma minutum*, Riley, is probably the most important natural enemy, 22·3 per cent. of eggs exposed for two days between 7th and 23rd July being parasitised. *Macrocentrus ancylivora*, Roh., was considerably less effective than during the previous year [**20** 356] and only survived the winter of 1931–32 in one locality. *M. delicatus*, Cress., which occasionally attacks the larvae, has been reared from the ragweed borer [*Epiblema strenuana*, Wlk.]. Pupal parasites are apparently of great importance, 32·2 per cent. of pupae collected from peaches in late July and early August being attacked by native species. Surprisingly large numbers of larvae of *C. molesta* (68·1 per cent. from peaches and 61·2 per cent. from apples) survived the winter in field cages. The numbers may be reduced on late varieties of peaches by banding the trees. From the point of view of control of the codling moth [*C. pomonella*, L.], the optimum time for cultivating apple orchards appears to be just before blossoming, when the greatest number are in the pupal stage ; pupae buried even 1 inch below the soil were not able to emerge, whereas 7·9 per cent. of the larvae 5 ins. deep crawled to the

surface and pupated. In studies of Longicorn root-borers [*cf.* **18** 582], *Prionus imbricornis*, L., and *Archodontes melanopus*, L., were reared from the roots of apple and *P. laticollis*, Drury, from those of white oak. Paradichlorobenzene has shown promise against the larvae of these Prionids in the soil.

Investigations on the Mexican bean beetle [*Epilachna corrupta*, Muls.] by F. Sherman showed that it spread little in 1931 and not at all in 1932. An unusually large percentage (30·3) emerged from hibernation in the spring of 1932, probably owing to the mild winter. Magnesium arsenate, used in sprays of various strengths or with dust lime, was highly toxic and caused little or no injury to the bean plants. When used alone as a dust, it gave 100 per cent. mortality of the adults and 96 per cent. of the larvae without damage to the plants, and with lime (1 : 8) it gave 88 per cent. mortality of the larvae. The mere presence of dust on the plants appears to be objectionable to the insects ; 44 per cent. of the larvae died on plants dusted with hydrated lime alone as compared with 12 per cent. on untreated plants. Dusts were preferable to sprays. A loss of 3–7 per cent. of tomatos is normally caused by the tomato fruitworm [*H. obsoleta*], against which a liquid poisoned Bordeaux spray has given the best average results over several years. Treatment has resulted in avoiding about one half of the injury caused to unsprayed fruit.

Wilcox (R. B.) & Beckwith (C. S.). **A Factor in the Varietal Resistance of Cranberries to the False-blossom Disease.**—*J. agric. Res.* **47** no. 8 pp. 583–590, 1 fig., 8 refs. Washington, D.C., 15th October 1933.

In studies of *Euscelis striatulus*, Fall. (blunt-nosed leafhopper), the vector of false-blossom disease [*cf. R.A.E.*, A **19** 580] in the United States, healthy cranberry cuttings representing 5 varieties were planted together in moist sand in flower-pots and covered with lantern globes the free end of which was closed with cheesecloth. Several leafhoppers were then introduced into each cage, and the number observed on each variety was recorded at intervals. The results, which are tabulated and discussed, showed that the order of attractiveness of the five varieties to the leafhoppers was the same as that of their susceptibility to the disease, as observed in the field, so that the apparent resistance of certain varieties to the disease may be partly due to resistance to the vector.

Ginsburg (J. M.). **Pyrethrum. Its Value in exterminating Insects.**—*Circ. N.J. agric. Exp. Sta.* no. 272, 4 pp. New Brunswick, N.J., March 1933. [Recd. December 1933.]

This circular comprises notes on the use of pyrethrum as an insecticide, with instructions for preparing a spray by stirring 13 fl. oz. of a commercial extract (containing 20 lb. of the dried flowers to the U.S. gal.) into 100 U.S. gals. of water in which $1\frac{1}{4}$ U.S. gals. of 40 per cent. potassium coconut-oil soap has been dissolved. The cost of 5 U.S. gals. should be less than 3*d*.

Ginsburg (J. M.). **Rotenone. Its Insecticidal Value.**—*Circ. N.J. agric. Exp. Sta.* no. 273, 2 pp. New Brunswick, N.J., March 1933. [Recd. December 1933.]

Formulae are given for home-made sprays prepared from a commercial acetone extract of derris or cubé (*Lonchocarpus nicou*)

containing about 5 per cent. rotenone and 20 per cent. total extractives. The concentrations recommended are 1 : 400 (about 1 oz. to 3 U.S. gals.) with the addition of 1 lb. skim milk powder or other non-alkaline spreader to 100 U.S. gals. for use against most chewing or sucking insects, and 1 : 800 (or against Aphids alone 1 : 1,600) with the addition of 0·25 per cent. coconut-oil soap against sucking insects only. The cost should vary from 1*d.* to about 4*d.* for 4 U.S. gals.

CLARK (S. W.) & FRIEND (W. H.). **California Red Scale and its Control in the Lower Rio Grande Valley of Texas.**—*Bull. Texas agric. Exp. Sta.* no. 455, 35 pp., 15 figs., 3 refs. College Station, Tex., September 1932. [Recd. December 1933.]

An account is given of observations carried out during 1925–31 on the bionomics and control of *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., which with its var. *citrina*, Coq., is the most serious pest of *Citrus* in the lower Rio Grande valley, weakening, and in severe cases killing, the trees and reducing the market value of the fruit. Studies begun in 1929 showed that reproduction is continuous through the year; it was most rapid during May–July, but the rate remained high until October. The insects developed almost twice as quickly in summer and autumn as in winter or spring. Females produced 27–300 larvae over 15–197 days, at the rate of about 6–7 daily; the entire life-cycle varied from 57 to 261 days. The larvae appear to settle by preference on the fruit. The Coccid attacks a wide variety of plants, a list of which is given. It is spread chiefly by wind and birds. *Chilocorus stigma*, Say (*bivulnerus*, Muls.) is the most important natural enemy, the larvae and adults attacking the adult scales. Parasites include *Aphelinus chrysomphali*, Merc., which attacks the typical (red) form of the scale and is quite abundant during the greater part of the year, *Prospaltella aurantii*, How., which has only been obtained once, from var. *citrina* [*R.A.E.*, A **18** 624], and the fungus, *Myriangium duriaei*, which was common in 1928, though climatic conditions are not usually favourable for its growth. Low temperatures during the winter of 1929–30 (with a mean of 40·72°F. for 10 days) had little effect on the emergence of the larvae and resulted in no more than the usual winter mortality [*cf.* **13** 344].

Tent fumigation with hydrocyanic acid gas gave very satisfactory control, but the cost of treatment and the fact that reinfestation occurred within 5 months made it uneconomic. Quick-breaking emulsions containing 2 per cent. slow-drying oil gave excellent control and were superior to those prepared with potash fish-oil soap. The tank-mixture method of application is apparently practicable in this area [*cf.* **19** 579, etc.]. Spraying was most effective in May–July [**18** 624]; two treatments gave better control than one, but where satisfactory control has been obtained in the preceding season, one will probably be sufficient. Measures successful against *Aonidiella* are effective against other Coccids on *Citrus*. Lime-sulphur applied six times at monthly intervals throughout spring and summer was unsatisfactory.

CLAUSEN (C. P.), JAYNES (H. A.) & GARDNER (T. R.). **Further Investigations of the Parasites of *Popillia japonica* in the Far East.**—*Tech. Bull. U.S. Dep. Agric.* no. 366, 58 pp., 18 figs., 15 refs. Washington, D.C., July 1933. [Recd. December 1933.]

A supplementary account [*cf. R.A.E.*, A **15** 297] is given of extensive investigations carried out in Japan, Korea, China and India during

1924–28 on the bionomics of parasites of *Popillia japonica*, Newm., and the methods by which they were reared and transported to the United States. In nature, the adults of *P. japonica* are parasitised in Japan by the Tachinids, *Centeter cinerea*, Ald., *Eutrixopsis javana*, Towns., *Hamaxia incongrua*, Wlk. (*Ochromeigenia ormioides*, Towns.), which was also reared from other species of *Popillia* in Korea, China and India, *Pexomyia genalis*, Ald. [**17** 109] and *Trophops clauseni*, Ald. [**20** 568], and the larvae by the Tachinid, *Prosena siberita*, F., and the Scoliid, *Tiphia popilliavora*, Roh. The last-named also parasitises other species of *Popillia* in Korea and China, as does *P. siberita* occasionally in Korea and India. Other parasites of *Popillia* spp. that are adaptable to *P. japonica* are the Ortalid, *Adapsilia flaviseta*, Ald. [**17** 109], reared from the adults in India, the Tachinid, *Dexia ventralis*, Ald., from the larvae in Korea, and the Scoliids, *Tiphia assamensis*, Allen & Jaynes, *T. clauseni*, A. & J., and *T. matura*, A. & J., in India, *T. notopolita*, A. & J., and *T. vernalis*, Roh., in Japan, Korea and China, *T. communis*, A. & J., in China, and *Tiphia* sp. in Formosa.

Other Scoliid parasites of Lamellicorn larvae that are more or less adaptable to *Popillia japonica* are *Campsomeris annulata*, F., *T. bicarinata*, Cam., *T. agilis*, Smith, and *T. asericae*, A. & J., in Japan, Korea and China, *T. totopunctata*, A. & J., *T. notopolita alleni*, Roberts, *T. phyllophagae*, A. & J., and *T. malayana*, Cam., in Korea and China, *T. brevilineata*, A. & J., *T. koreana*, Roh. [**15** 251], and *T. ovidorsalis*, A. & J., in Korea, *T. biseculata*, A. & J., in Japan, and *T. pullivora*, A. & J., in India. It is hoped that some of these may be of value in the United States against *Anomala orientalis*, Waterh., *Aserica* (*Autoserica*) *castanea*, Arrow, and *Serica similis*, Lewis [*cf.* **17** 444, etc.].

The following is taken largely from the author's summary: *Centeter cinerea* has maintained its status as a major factor in the control of *P. japonica* in northern Japan, even where there has been an extensive collection of parasitised hosts during the past 8 years. Its distribution extends south to the Tokyo-Yokohama district. *Hamaxia incongrua* has been found in varying abundance in numerous additional localities in central Japan. It prefers semi-forested and waste areas covered with shrubs, rather than cultivated land. *Eutrixopsis javana*, *Pexomyia genalis*, which has at least 2 generations a year, and *Trophops clauseni*, of which the larval period is at least 12 days and the pupal 20, were all found in very small numbers in Japan, where they are of no value in the control of the beetle. *Adapsilia flaviseta* occurs in the hills of Assam; the rate of parasitism by it is low, except occasionally in limited areas. It has one generation a year, principally in *Popillia cupricollis*, Hope, and occasionally in *P. cyanea*, Hope, or *P. macclellandi*, Hope. The winter is passed in the puparium in the host beetle under the ground or in rubbish near the surface; emergence begins in mid-July, oviposition continuing until the first half of August. Hatching occurs within 3 days and pupation within 15–18, the host being killed 3–4 days before pupation and its body contents consumed. The potential value of this parasite is low, as most of the eggs are laid in male beetles and the relatively long larval period permits a parasitised female to continue ovipositing. During the breeding work, the puparia were attacked by *Spalangia* sp. and a Eulophid. The larval forms and method of attack were identical with those previously observed on puparia of *Centeter* in Japan, and it is probable that these hyperparasites occur generally on exposed puparia in the soil or on the surface. *Prosena siberita* is present in the field from early April till the end of September; it is of value against *Popillia* only in

northern Japan. *Dexia ventralis* has 3 generations annually when the winter is passed in *Miridiba koreana*, Niij. & Kino., but only 2 in *Popillia*, and its evident adaptability to the habits of the host species greatly enhances its potential value in the United States. Though the larvae of the two last-named Tachinids usually pupate in hosts that are also pupating, they can develop in partly-grown grubs.

Much of the information on the Scoliids has been previously noticed [**21** 14]. None of those parasitic on *Popillia* has a uniform distribution comparable to that of the host, and a high percentage of parasitism is found rarely and in restricted areas. *T. popilliavora* in Japan, *T. vernalis* in Korea and *T. matura* in India are the most effective in their native habitats. The eventual value of this group in the United States lies in the possibility of having a series of these species rather than any single one. Their increase and distribution depends mainly on the food supply of the adults.

During 1920–28, extensive shipments were made, including about 500,000 puparia of *C. cinerea* and 298,000 live adults of *P. japonica* partly parasitised by *H. incongrua* from Japan, 17,662 puparia of *A. flaviseta* from India, 21,324 larvae parasitised by *D. ventralis* from Korea, and 13,600 by *Prosena siberita* from Japan, besides 159,000 collected in the field, of which 10 per cent. were parasitised by the last-named species. Shipments were made of all the Scoliids mentioned (except *T. assamensis*, *T. clauseni* and the Formosan species), comprising 69,334 adults, 103,212 reared cocoons, 93,815 cocoons collected in the field and 6,416 parasitised host larvae. It was usually cheaper and more satisfactory to dispatch Scoliid adults than cocoons, provided that the journey did not exceed 30 days.

O'Kane (W. C.), Walker (G. L.), Guy (H. G.) & Smith (O. J.). **Studies of Contact Insecticides—VI. 1. Reactions of certain Insects to controlled Applications of various Concentrated Chemicals. 2. A new Technique for initial Appraisal of proposed Contact Insecticides.**—*Tech. Bull. N.H. agric. Exp. Sta.* no. 54, 23 pp., 4 figs. Durham, N.H., June 1933. [Recd. December 1933.]

When chemical compounds are tested for their value as contact insecticides by diluting them in water or emulsifying them with soap, a caseinate, etc., their components may be altered and their full insecticidal potentialities influenced. Moreover, by spraying them on such insects as Aphids, their performance may be definitely affected according to the size of droplet delivered. The intrinsic toxicity of a substance of unknown quality would be best discovered if minute quantities of it were applied in a concentrated form and a definitely controlled manner to a series of sufficiently resistant insects, the optimum method of preparing a spray from it being ascertained subsequently.

For this reason, tests, the results of which are described in detail, were made of the sensitiveness of different parts of the larvae of *Tenebrio molitor*, L., and cockroaches to minute drops of pyrethrum extract, nicotine, oil, etc. The time elapsing before the onset of convulsions was noted and was used in further experiments to determine the value of 45 organic compounds (which are not specified) when applied to sensitive areas of *T. molitor*. Marked reactions were obtained with 16, only 4 of which gave promising results when tested as sprays against Aphids. Alterations in the methods of dilution or

other measures to improve the physical character of diluted sprays made from these 16 materials improved their performance, in a marked degree in some cases.

CHAWNER (E. F.). *Diprion polytomum* **Htg. (Hym., Tenthr.) in Hants.** —*J. ent. Soc. S. Engl.* **1** pt. 4 p. 81. Southampton, 16th December 1933.

Diprion polytomum, Htg., was found for the third time in the British Isles [*cf. R.A.E.*, A **21** 427] in September 1933, when a larva was taken in Hampshire at the foot of a spruce tree, from which it had probably been washed by heavy rain. The larvae feed singly on the tops of the high trees and construct cocoons on the twigs. Its habits and colouring make this species difficult to observe, and it may be more common than the records of it indicate.

BARNES (H. F.). **Grass Seed Production and Gall Midges.**—*Herbage Reviews* **1** no. 1 pp. 7–9, 8 refs. Aberystwyth, Wales, 1933.

In view of the increased production of grass seed in England, a brief review is given from the literature of Cecidomyiids that seriously affect the industry by preventing the setting of the seed.

NEWTON (H. C. F.). **On the Biology of some Species of** *Longitarsus* **(Col., Chrysom.) living on Ragwort.**—*Bull. ent. Res.* **24** pt. 4 pp. 511–520, 11 figs., 4 refs. London, December 1933.

During work on the insect enemies of ragwort (*Senecio jacobaea*) in 1928–29, observations were made on Halticids of the genus *Longitarsus* living on this weed in eastern England. *L. jacobaeae*, Waterh., *L. succineus*, Foudr., *L. dorsalis*, F., and *L. gracilis*, Kutsch., were the species collected ; *L. dorsalis* was not as common as the other species, being apparently confined to the southern half of England. The immature stages of each are described.

L. jacobaeae was the most abundant species, and its var. *rufescens*, Fowler, was occasionally present. *S. jacobaea* is the only recorded food-plant, but in the laboratory 30–80 per cent. of the adults survived when fed on other species of *Senecio* and 50 per cent. on sunflower (*Helianthus* sp.). The first adult appeared at the end of July, the numbers reaching a maximum in late August. The eggs are laid in the soil. The first, which were observed in mid-August, hatched in a month or less, but later ones not until the following spring, so that both eggs and larvae overwintered. The larvae fed on the roots of ragwort, but even when they were numerous its growth was not noticeably affected. Fully-grown larvae are found from June onwards. Pupation takes place in an earthen cell, and the pupal stage lasts 2–3 weeks. There is only one generation a year. The young ragwort plants were well established by the time that mass emergence of the beetles occurred, and thus did not suffer severely from them.

The recorded food-plants of *L. dorsalis* are *Senecio* spp. and probably *Erigeron canadense*, but in the laboratory some of the beetles survived on other Composites. Adults appeared in April and were present until July. Oviposition continued from the end of April till June, the eggs being laid in the soil. Young larvae were seen in August, and pupae at the end of September and early October ; the adults emerged in the latter month and overwintered.

L. succineus and *L. gracilis* were only found on *S. jacobaea* and had similar life-histories. The incubation period was 2–3 weeks. Eggs were observed in late June and larvae in early August. In October, adults were scarce in the field, but gravid females were still alive in the laboratory and half-grown larvae were present in the soil. Hibernation probably takes place in the larval and pupal stages.

General observations indicate that the effect of these beetles on ragwort is very small.

Wood (A. H.). **Notes on some Dipterous Parasites of** *Schistocerca* **and** *Locusta* **in the Sudan.**—*Bull. ent. Res.* **24** pt. 4 pp. 521-530, 10 figs., 7 refs. London, December 1933.

Experiments were carried out in the Sudan to test the accuracy of records of *Sarcophaga destructor*, Mall., parasitising *Schistocerca gregaria*, Forsk. [*cf. R.A.E.*, A **19** 27]. Adults were easily kept in captivity, and deposited larvae on overripe fruits. In the Sudan, the larvae cause considerable damage in winter to melons, tomatos, and egg-plants [*Solanum melongena*]. The larval stage lasted 5–6 days and the pupal 12–22 ; under dry conditions, however, there is sometimes a pupal diapause of 2–3 months. Adults were abundant in the field from August to February, presumably being carried over the dry season from February to July in the pupal stage. Females caged with locusts at all stages of development did not deposit larvae on them. Larvae dissected from the flies [**13** 98] and placed near the wing bases of locusts only succeeded in penetrating them immediately after they had moulted. Infested locusts sickened rapidly and died in 2–3 days, and the fully fed larvae emerged after 3–4 days. When two larvae were present, 92 per cent. of the locusts died, whereas when one larva entered, only 16 per cent. died, the survival of the remainder being due to the early death of the larvae in them. The larvae did not grow normally till the host had died. Moulting locusts did not attract the flies, but mutilated or wounded ones were definitely attractive, and larvae were deposited in the wound. It is not probable, however, that this species often attacks locusts in nature.

Of several hundred parasitised locusts collected from the Red Sea coast in the winters of 1931–32 and 1932–33, none contained larvae of *S. destructor*, but varying percentages were parasitised by *Blaesoxipha lineata*, Fall., and *B. filipjevi*, Rohd., neither of these species having been previously recorded from the Sudan.

B. lineata was abundant in the field from November to February, parasitising *S. gregaria* and *Locusta migratoria* [*migratorioides*, R. & F.]. Gravid females caged with last-instar hoppers and immature adults of *Locusta* deposited larvae on some of them. Only one larva was found in each host. The supply of parasites was maintained by removing larvae from gravid females and inserting them under a raised flap of chitin on the pronotum of a locust. There were three larval instars. The pupal period was 8–20 days. The larva fed only on the fat-body ; if the host died before the larva was full grown, the latter died also. Of the artificially parasitised locusts, 78 per cent. recovered, and 38 per cent. of these reproduced [*cf.* **18** 129]. When two larvae were inserted, the host invariably died, and a small percentage in the field contained more than one larva.

In the laboratory, *B. filipjevi* could only be reared by parasitising the locusts artificially. The larval stage, comprising 3 instars, lasted about 6 days, and the pupal 14–17. The larvae fed on the fat-body, but

if this was exhausted before they were full-grown, they attacked the muscles and other tissues. Up to 11 larvae were bred from one locust. The death of the host does not interfere with the development of the larvae, so that it is a more efficient parasite than *B. lineata*. It was reared from *S. gregaria*, *L. m. migratorioides* and *Anacridium moestum*, Serv.

Descriptions are given of the larvae and pupae and figures of the larvae and the male genitalia of the three flies.

GOLOVYANKO (Z. S.). **Results obtained with Polychlorides and Paradichlorobenzene against the Larvae of *Polyphylla fullo*, L., and *Melolontha hippocastani*, F.**—*Bull. ent. Res.* **24** pt. 4 pp. 531–536, 1 pl. London, December 1933.

The author summarises the results of experiments in two forest areas, in central Ukraine and near Kiev, with soil fumigants against larvae of *Polyphylla fullo*, L., and *Melolontha hippocastani*, F., respectively [*cf. R.A.E.*, A **19** 110, 111 ; **20** 145]. Applications of about ¼ oz. polychlorides or paradichlorobenzene in holes 4 ins. deep and 14 ins. apart gave 100 per cent. mortality of *Melolontha* in 1930, whereas ½ oz. polychlorides 28 ins. apart killed only 65–75 per cent.

Light and dark polychlorides and paradichlorobenzene, in dosages of about 57 lb., 42 lb. and 29 lb. to each experimental plot (measuring 70 ft. by 70 ft.), were applied in holes 4 or 8 ins. deep and 28, 21 or 14 ins. apart against *Polyphylla* in 1931 and 1932. The paradichlorobenzene was either distributed evenly over the bottom of the holes, which were each 16 sq. ins. in area, or heaped in one part. Light polychlorides, which consisted chiefly of dichlorobenzenes with small quantities of chlorobenzene and higher polychlorides, were more toxic than dark ones, and were not much inferior to paradichlorobenzene, especially in warm, dry weather and when the most effective methods were used. Under favourable conditions, however, in 1931, the dark polychlorides (1 oz. in holes 4 ins. deep and 28 ins. apart) gave 99·3 per cent. mortality in a plot with about 19 larvae to the sq. yard. The results obtained in 1932 were inferior, owing to the wetter season. Both chemicals were more effective when applied in holes 8 ins. deep ; when small quantities were used, the increase in effectiveness was 12–18 or even 28–33 per cent. Paradichlorobenzene applied in relatively large quantities to each hole gave better results when evenly distributed than when heaped, because the latter method hindered evaporation ; with small quantities, however, the difference was insignificant. Both chemicals gave better results when small quantities were applied in holes 14 ins. apart than with large quantities 28 ins. apart. From an economic point of view, however, the dosage recommended is 0·7–1 oz. in holes 28 ins. apart and 8 ins. deep, which amounts to 375–490 lb. to the acre.

Trees planted in a treated area after heavy infestation by *Polyphylla* should be placed close together, in order to obtain as soon as possible a canopy that will prevent a fresh mass oviposition.

CHIAROMONTE (A.). **Considerazioni entomologiche sulla coltura delle piante ortensi nella Somalia Italiana.** [Entomological Notes on the Cultivation of Kitchen-garden Plants in Italian Somaliland.]—*Agric. colon.* **27** no. 11 pp. 523-529. Florence, November 1933.

Most of the vegetables grown in Italian Somaliland have been introduced for use by Europeans. A comprehensive record of the insects

infesting them is given, of which the following are the more injurious : the Meloids, *Epicauta albovittata*, Gestro, *E. jeanneli*, Pic., *Mylabris* (*Zonabris*) *convexior*, Pic., and *Ceroctis rufimembris*, Thomas, *Heliothis obsoleta*, F., and the Coreid, *Acanthomia horrida*, Germ., all on beans ; *Prodenia litura*, F., on beans, beet and cabbage ; *Crocidolomia binotalis*, Zell., on cabbage ; *Dacus ciliatus*, Lw. (*brevistylus*, Bezzi) infesting the fruits of pumpkin and *Capsicum* ; *Anomala* spp., which attack the roots of all the plants mentioned above as well as tomato and egg-plant [*Solanum melongena*] ; *Thrips tabaci*, Lind., on onion ; *Diacrisia* (*Spilosoma*) *investigatorum*, Karsch, and *Crioceris nigropunctata* f. *defecta*, Wse., on asparagus ; and *Xanthodes graellsi*, Feisth., *Earias insulana*, Boisd., *Oxycarenus hyalinipennis*, Costa, and *Dysdercus cardinalis*, Gerst., on *Hibiscus* [*esculentus*].

A number of parasites and predators are also listed, some of which have already been noticed from Italian Somaliland [*R.A.E.*, A **18** 450, 659 ; **21** 584, 643 ; **22** 12]. Others include the Aphelinid, *Prospaltella sublutea*, Silv., in an Aleurodid, *Bemisia* sp., on beans, and the Coccinellid, *Cydonia propinqua* var. *quadrilineata*, Muls., and the Syrphid, *Ischiodon aegyptius*, Wied., preying on *Doralis* (*Aphis*) *gossypii*, Glov., on cucurbits.

MOREAU (A. P.). **Un nouvel ennemi du cotonnier en Afrique équatoriale française** *Helopeltis bergrothi* **Reut.**—*Agron. colon.* no. 191 pp. 129–140, 2 figs., 3 refs. Paris, November 1933.

An account is given of observations carried out from August 1932 to February 1933 in the Ubangi Territory, French Equatorial Africa, on the damage caused to cotton by *Helopeltis bergrothi*, Reut., which had not hitherto been recorded from this region. It is not known how this Capsid passes the dry season. The bugs appeared in September and had become most numerous by the end of the wet season in October–November, when most of the damage was done. The life-cycle from egg to adult lasted about a month. Eggs were laid on cotton under the bark of the stem or branches or in the pedicels, usually singly or in batches of 2–3, 10–15 eggs being sometimes deposited on one plant and none on others that were subsequently also attacked. The bugs were very seldom found on any other plant when cotton was available [*cf. R.A.E.*, A **14** 223 ; **16** 242], but infestation always started at the periphery of the fields.

In experiments in which various parts of healthy cotton plants were exposed to infestation, the stem, leaves, bolls and cotyledons were readily punctured, but the seeds were not attacked. The stem finally became dry and brittle, the endocarp and seeds in the bolls turned black and the fibre decayed, and the leaves and cotyledons showed spots of a peculiar angular shape resembling those produced by *Bacterium malvacearum*, to which the damage had hitherto been attributed. The spots did not, however, become larger after the removal of the bugs, as is usual in the case of a bacterial infection, and they were distinguished by being confined to the edges of leaves and by the absence of gum. Moreover, the bacterial disease appears as early as June, whereas the first injury by *H. bergrothi* was observed in October. The condition known as " black-arm," which is economically more important than infection by *B. malvacearum*, was shown to be due entirely to *H. bergrothi* ; plants grown from seeds that had been mixed with trash of cotton showing symptoms of " black-arm " did not

exhibit more severe symptoms when attacked by the Capsid than plants from seeds disinfected with carbon bisulphide or sulphuric acid against *B. malvacearum*. The author believes therefore that "black-arm" is either a direct result of leaf punctures by *H. bergrothi* or possibly due to a virus disease transmitted by it.

No natural enemies were observed, and in experiments the Capsids were only very occasionally attacked by a Reduviid, *Phonoctonus* sp. It is suggested that plants infested before and during October should be pulled up and burnt to destroy the eggs.

HAINES (G. C.). **Top-dressing Maize for the Control of Stalk-borer.**—*Fmg S. Afr.* 1933 reprint no. 64, 2 pp. Pretoria, November 1933.

Notes are given on the application of derrisol to the tops of maize for the control of the larvae of *Busseola* (*Calamistes*) *fusca*, Fuller, in South Africa [*R.A.E.*, A **19** 56]. The first treatment should be given when a very small percentage of the inner leaves is perforated and about a third of the foliage mottled. Only noticeably infested plants require a second treatment unless the attack is fairly general. Over small areas, a large oil-can or a bottle with a quill inserted in the cork may be used, but applications on a large scale are best made by means of a two-gallon knapsack [**18** 160] with a long rubber tube, the flow through which is regulated by compressing by hand or by a metal stop-cock. Small plants may be more easily reached if a metal or bamboo tube is added, and regulated doses may be squirted into the tops of the plants by attaching a syringe.

HALL (W. J.) & FORD (W. K.). **Notes on some Citrus Insects of Southern Rhodesia.**—*Publ. Brit. S. Afr. Co.* no. 2 pp. 1–51, 1 fldg map, 1 graph. London & Salisbury, 1933. Separately printed as *Publ.* no. 2a.

Detailed notes are given on the bionomics of the major, minor and potential pests of *Citrus* in Southern Rhodesia, and the control measures practised against some of them on the estates of the British South Africa Company, particularly at Mazoe, together with a systematic and partly annotated list of all insects hitherto observed on *Citrus* in the Colony. Reference is made to additional insects recorded from the Union of South Africa, and a section on miscellaneous species other than insects includes a mite, *Tenuipalpus* sp., which is present on the fruit at certain times in the year but does no apparent damage. A plan of the Mazoe *Citrus* estate, a table of its rainfall data for 1919–32, and a graph of the mean weekly maximum and minimum temperatures, relative humidity and evaporation are appended.

Infestation by *Aonidiella aurantii*, Mask., a major pest, appears to decrease with the decreased vitality of the tree. Recently, it has been so slight at Mazoe that it was suggested that annual fumigation was not necessary on all trees. In 1931, however, the value of the fruit for export lost in one grove that was only partly fumigated was approximately equal to the cost of the entire fumigation of all trees for the year. The most severe infestations occurred on trees coated with dust from a road, which, apparently by rendering the scales more resistant, necessitated further fumigation. Some control is exercised by *Aphelinus* (*Aphytis*) *chrysomphali*, Merc.

Against *Scirtothrips aurantii*, Faure, the other major pest, trees are sprayed annually with 1 gal. lime-sulphur and 8 oz. spreader in

100 gals. water [*R.A.E.*, A **18** 633], with the addition, in groves where *Doralis* (*Aphis*) *tavaresi*, del Guer., is present, of 3 oz. nicotine (95–98 per cent.). In experiments in 1932, colloidal sulphur (1 : 400) gave promising results. Infestation in that year was slight, probably owing to a prolonged cold spell during late July and early August, which arrested the development of the thrips till the fruit was well advanced.

Observations over a number of years on *D. tavaresi* [*cf.* **13** 78] have shown that hot weather in August or September checks development, the optimum temperature for it being 75–80°F. Low humidity is also probably an important controlling factor in October–November.

Among the minor pests was *Coccus* (*Lecanium*) *hesperidum*, L., which increases rapidly in warm, wet weather and in 1932 was chiefly responsible for the growth of sooty mould, though a certain amount was probably due to *Ceroplastes destructor* var. *brevicauda*, Hall (waxy scale) and *Saissetia subpatelliformis*, Newst. (hard black scale).

Only the first generation of *Heliothis obsoleta*, F., occurs on *Citrus*, the eggs being often laid on the flowers. The larvae are most conspicuous towards the end of September, and pupation begins about the first week of October. The degree of infestation, which is usually heaviest on healthy trees, varies from year to year, sometimes as many as 1,000 eggs or more being laid on a single tree. The severe outbreak in 1932 [**21** 522] was probably due in part to abnormally heavy rainfall (2·19 inches) in August. Heavy parasitism (94 per cent.) of the larvae by Tachinids, *Gonia* sp., *Sturmia* sp., two adults of which were once reared from one host larva, and (less frequently) *Pachyophthalmus signatus*, Mg., has been recorded during the last four years. These parasites do not kill the host until it is fully grown. A Braconid, *Chelonus* sp., was once reared from the larvae, and certain spiders have been noticed preying on the smaller ones.

The Braconid, *Apanteles pallidocinctus*, Gah., was reared from the larvae of possibly both *Papilio demodocus*, Esp., and *P. nireus* var. *lyaeus*, Dbl., which are occasionally pests of *Citrus*. Usually ten parasites emerged from each larva. One example of a Eupelmid, *Anastatus* sp., was reared from the egg of one of these butterflies.

To control *Argyroploce leucotreta*, Meyr., all fallen or obviously infested fruit should be buried, and off season fruit should be avoided.

NAUDÉ (T. J.) & ALLWRIGHT (W. J.). **Control of Citrus Thrips. Experimental Work at Muden.**—*Fmg S. Afr.* 1933 reprint no. 52, 3 pp. Pretoria, September 1933.

Experiments were carried out in Natal on the comparative efficiency of sprays of lime-sulphur [*cf. R.A.E.*, A **18** 242 and preceding abstract] and commercial sulphur dusts against *Scirtothrips aurantii*, Faure, in view of the serious damage caused to *Citrus* during 1930–31. Results obtained on orange in small scale experiments in 1931–32 were confirmed by the treatment of three orchards in 1932–33, when infestation was lighter. Fruit from trees that had received two applications of $\frac{3}{4}$ lb. sulphur dust (one when about 75 per cent. of the petals had fallen and the other 9 days later) or one of 1 lb. compared favourably with that from trees sprayed with $2\frac{1}{2}$ or $4\frac{1}{2}$ gals. of 1 per cent. liquid lime-sulphur (containing 8 oz. spreader to 100 gals.) at a pressure of 300 lb. per sq. in. Dry lime-sulphur (3 lb. to 80 gals.) was less satisfactory. The effect of dusting was apparently not influenced by temperatures of 52–90°F. or by varying degrees of humidity, and two applications from both sides of the trees were more effective than one from both

sides or two from one side. Dusts have numerous advantages over sprays, including the rapidity with which trees may be treated, the better coverage of the fruit and the lower initial cost of machinery.

ULLYETT (G. C.). **The Mass Rearing of *Microbracon brevicornis*, Wesm.** —*S. Afr. J. Sci.* **30** pp. 426–432, 5 refs. Johannesburg, 1933.

Observations on *Microbracon brevicornis*, Wesm., in the Transvaal showed that it is a parasite of *Heliothis obsoleta*, F., not only on *Antirrhinum* [*cf. R.A.E.*, A **20** 624] but on various other garden plants and in fields of maize, where it caused a 10 per cent. parasitism in early December. In view of this, investigations are being made on the possibility of breeding it for the control of the bollworm in cotton. *Plodia interpunctella*, Hb., was chosen as a host for mass breeding because it could be handled easily, and once an infestation of grain had been started in the laboratory, no more labour and very little expense was necessary to maintain it. It was reared in trays holding 25 lb. of maize at about 27°C. [80·6°F.] and 80 per cent. relative humidity, and the larvae were collected on sheets of corrugated cardboard, on which they congregated for pupation.

The technique of parasite rearing is outlined. The females could be kept alive for some time on raisins alone, but animal food was essential before oviposition took place ; when raisins alone were used, the first larvae supplied were utilised as food and not parasitised. The males do not feed on the host, but were more vigorous when fed on raisins. The optimum temperature between emergence and pairing was 30°C. [86°F.], which was also suitable for oviposition. Females were confined in Syracuse watch glasses (3 to each) with 30–36 larvae. After a day, most of these were parasitised and were then removed. The best results were obtained when 3–4 parasite larvae developed in one host. The optimum temperature for incubation and larval development was 80·6°F., with 60–70 per cent. relative humidity ; under these conditions, the period from egg to adult was 8 days.

Adult females of *M. brevicornis* survived periods up to 3 weeks in cold storage at 38–42°F. with a relative humidity of about 90 per cent. In prolonged storage, it was necessary to remove them periodically for feeding in order to maintain their reproductive powers. For transport, the parasite larvae were allowed to pupate on cardboard disks, which were packed (6–8 together) in ointment tins and covered with cellophane before the latter were closed. The cellophane was not removed until the adults had emerged and paired, so that fertilised females could be released in the field.

D'ANGREMOND (A.). **Verslag van den directeur van het Algemeen Proefstation der A.V.R.O.S. 1 Juli 1932–30 Juni 1933.** [Report for 1932–33 of the Director of the General Experiment Station of the A.V.R.O.S.]—*Meded. alg. Proefst. A.V.R.O.S.*, Alg. Ser. no. 53, 53 pp. Medan, 1933.

The Eumolpid, *Demotina sumatrana*, Jac., is recorded for the first time (p. 38) as eating the buds of newly pruned tea plants in Sumatra.

VEITCH (R.). **Report of the Chief Entomologist.**—*Rep. Dep. Agric. Qd 1932–33* pp. 58–61. Brisbane, 1933.

Dacus ferrugineus, F. (*Chaetodacus tryoni*, Frogg.) was more abundant in orchards of deciduous fruit trees in the Stanthorpe district, Queensland, during 1932–33 than in previous years [*cf. R.A.E.*, A **21** 105].

It was also a minor pest of *Citrus*, owing largely to the prolonged summer. Infestation of apples by *Calandra oryzae*, L. [*loc. cit.*] was less prevalent. The weevil, *Orthorrhinus cylindrirostris*, F., and the fruit-piercing moth, *Othreis fullonica*, L., which are common *Citrus* pests, also caused damage in vineyards. *Nysius vinitor*, Berg. (Rutherglen bug) was abundant on *Citrus* in two districts. Good control of the larvae of *Heliothis obsoleta*, F., on cotton was obtained by swabbing the plants with a mixture of lead arsenate, molasses and water. Larvae of *Lepidiota caudata*, Blackb., caused losses of *Paspalum* in one district.

Chisholm (E. C.). **Useful Coccinellidae found on the Comboyne Plateau.**—*Proc. Linn. Soc. N.S.W.* **58** pt. 5–6 pp. 405–407, 8 figs. Sydney, 15th December 1933.

Notes are given on the following Coccinellids observed on the Comboyne Plateau, New South Wales, together with the Aphids they attack: *Leis conformis*, Boisd., *Coccinella repanda*, Thnb., *Verania frenata*, Er., *V. lineola*, F., *Coelophora inaequalis*, F., *C. veranioides*, Blackb., and *Callineda testudinaria*, Muls. *Leptothea* (*Halyzia*) *galbula*, Muls., feeds on *Oidium* (mildew) on rose leaves and has been found on grape vines, evidently feeding on a fungus that attacked the leaves and possibly predacious on young larvae of the Agaristid, *Phalaenoides glycinae*, McLeay.

French (C.) & Pescott (R. T. M.). **Native Insect Pests of the Orchard and Garden.**—*J. Dep. Agric. Vict.* **31** pt. 11 pp. 580–582, 3 figs. Melbourne, November 1933.

Various insects indigenous to Victoria have for many years tended to migrate from their wild food-plants to plants of economic importance, owing probably to the destruction of the former and to an increase in numbers due to the supplanting of insectivorous birds by introduced species. Among those here dealt with, *Dindymus versicolor*, H.-S. (harlequin bug) has recently caused serious damage to fruit trees and grape vines, as well as various vegetables and garden flowers [*R.A.E.*, A **21** 554]. In early summer the eggs are laid on the lowest leaves of the food-plants, and in late summer in rubbish, under logs and stones, and in crevices of old wood. The nymphal stage lasts 3–4 weeks. The bugs feed on the fruit, which shows spotting and a slight tendency to wilt; they attack almonds in the soft, green stage, and severe gumming of the fruit results. On garden plants, they attack the young growing tips, killing the shoots and preventing normal growth.

The native food-plant of the Coreid, *Mictis profana*, F. (holy bug) is *Acacia*, but it now infests *Citrus*, causing the wood of young shoots to appear scorched and checking growth. Often the whole tree dies back to the old wood. The eggs are laid mainly on the food-plants, but sometimes in similar places to those selected by *D. versicolor*. The Lygaeid, *Nysius vinitor*, Bergr., breeds chiefly on weeds. After a nymphal period of 3–4 weeks, many of the adults migrate to fruit trees, bush fruits or vegetables [*cf.* **7** 199; **17** 104], to which they cause serious injury.

Various contact sprays are recommended for the control of these three bugs, as well as the use of sulphur smudge fires [**20** 246] for driving *N. vinitor* from fruit trees.

NICHOLLS (H. M.). **The Cherry-borer Moth.**—*Tasm. J. Agric.* N.S. **4** no. 4 pp. 167–170, 3 figs. Hobart, 1st November 1933.

Considerable damage is sometimes caused to fruit trees in Tasmania by *Cryptophasa* (*Maroga*) *unipunctata*, Don. (*gigantella*, Wlk.) [*cf. R.A.E.*, A **22** 41]. The young larvae construct tunnels in the bark (usually in a downward direction), which the older ones use mainly for shelter, feeding at night on the bark, twigs and young buds, particularly in winter. More serious damage is often caused by the entrance through the burrows of fungi, which sometimes kill the branches and occasionally the entire tree. The larval stage probably occupies over a year. The larvae may be killed in their burrows by means of a wire or by injecting kerosene or carbon tetrachloride [*cf.* **21** 30]. Kerosene sometimes harms the trees, especially cherries, but carbon tetrachloride has caused no noticeable injury. A spray of lead arsenate and flour paste would probably be effective when the larvae are feeding on the bark and buds.

MAYNE (R.) & VAN DEN BRUEL (W.). **Rapport et recherches sur la mouche de la betterave** (*Pegomyia hyoscyami* **Panz.**).—*Bull. Inst. agron. Gembloux* **2** nos. 3–4 pp. 177–214, 273–309, 12 figs., 51 refs. Gembloux, August–November 1933. (With Summaries in Dutch, German and English.)

Owing to drought, the injury caused to sugar-beet in Belgium by the first generation of *Pegomyia hyoscyami*, Panz., in 1932 was more serious than usual, but the crops were saved by heavy rainfall at the end of June. In one locality, eggs of the first generation were found in field cages from 18th May to 5th July, those of the second from 7th July to 8th August and those of the third from 20th August to 13th September. As some pupae of the second generation overwintered, injury by the third was less serious. At the height of activity, rain has little effect on daily oviposition ; high temperatures accelerate the first and third generations.

The percentage of larval parasitism [*cf. R.A.E.*, A **21** 325, 443] varied in different localities from 0 to 11·2 in the first generation, 0 to 16·6 in the second, and 1·96 to 32·3 in the third. The parasites recorded were *Opius fulvicollis*, Thoms., *O. nitidulator*, Nees, *O. spinaciae*, Thoms., *O. ruficeps*, Wesm., *Biosteres* (*O.*) *carbonarius*, Nees, and *Phygadeuon pegomyiae*, Hbm. An egg-parasite thought to be *Trichogramma evanescens*, Westw., was also observed. The Anthomyiid, *Coenosia tigrina*, F., was a fairly common predator, and *Aleochara bipustulata*, L., was much commoner than *A. bilineata*, Gyll. *Smynthurus viridis*, L., which has been reported as attacking the eggs of *P. hyoscyami* in Holland [**20** 711], is common in Belgium, but was not observed to be predacious ; *Bourletiella* (*S.*) *lutea*, Lubb., which was frequently observed feeding on sugar-beet cotyledons, possibly also attacks the eggs.

When applied at midday in fine weather, sweetened sodium fluoride sprays were effective against the adults in the field. In the laboratory, sprays of 0·4 per cent. sodium fluoride and those of 0·2–0·3 per cent. sodium fluosilicate were about equally effective [but *cf.* **21** 325]. Higher concentrations were repellent. Barium fluosilicate gave good results but had a much slower action. Synthetic cryolite was much less toxic. The addition of 2 per cent. skimmed milk increased the efficacy of the sprays by improving their wetting power. The addition

of 2 per cent. sugar only slightly increased their attractiveness ; 4 per cent. molasses gave better results, apparently owing to its greater wetting power.

KRIEG (H.). **Rotenon, ein neues wirksames und zukunftsreiches Insektenbekämpfungsmittel.** [Rotenone, a new and effective Insecticide with a great Future.]—*Chemikerztg* **57** no. 96 p. 949, 13 refs. Köthen, 2nd December 1933.

This is a review from the literature of the chemical constitution and insecticidal properties of rotenone. Brief reference is made to the agents used for extracting it from plant material.

FRICKHINGER (H. W.). **Gase in der Schädlingsbekämpfung.** [Gases in the Control of Pests.]—*Flugschr. dtsch. Ges. angew. Ent.* no. 13, 88 pp., 38 figs., 16 pp. refs. Berlin, P. Parey, 1933. Price *M*.4·50.

This survey of the uses of gases in the control of pests is arranged according to the fumigants, nearly half of the text being devoted to hydrocyanic acid gas and 12 pages to ethylene oxide. Information is given on the nature of each of the eleven fumigants dealt with, the methods of using it and the pests against which it is employed. The bibliography has a general section followed by sections for each fumigant.

PETERS (G.). **A short Guide to Tree Fumigation.**—2nd Edn Cr. 8vo 191 pp., 90 figs. Frankfort-on-Main, Dtsch. Ges. SchädlBekämpf., 1934.

In this revised and enlarged edition of a booklet already noticed [*R.A.E.*, A **20** 48], additional information includes notes on factors affecting the resistance of trees to injury by hydrocyanic acid gas ; a description of an apparatus for determining electrically the concentration of gas at any given point during the process of fumigation ; chapters on the organisation of *Citrus* fumigation in various countries, the determination of the kill of scales obtained, and the influence of atmospheric humidity on the release of HCN from calcium cyanide ; and notes on the fumigation of vine stocks, plant consignments and packed fruit.

NITSCHE (G.) & LANGENBUCH (R.). **Der Kohltriebrüssler** (*Ceuthorrhynchus quadridens* **Panz.**) **als Grosschädling im Kohlanbau.** [The Cabbage Stem Weevil as an important Pest in Cabbage Cultivation.]—*NachrBl. dtsch. PflSchDienst* **13** no. 12 pp. 101–103, 5 figs. Berlin, December 1933.

In 1932 and 1933, the larvae of *Ceuthorrhynchus quadridens*, Panz., were responsible for much injury to red cabbage in two localities west of Berlin. This injury was very similar to that caused by the cabbage maggot [*Phorbia brassicae*, Bch.], and it is believed that much of the damage attributed to the latter in Germany is really due to *Ceuthorrhynchus*. Oviposition occurred chiefly in the seed-beds in late May and early June, the date of sowing being the factor governing injury to cauliflower, white cabbage and savoys. Eggs were laid in the main stalks above ground if they had not become too woody. In very early

varieties, in which oviposition was confined to the stalks and mid-ribs of the outer leaves, no noticeable injury resulted. Very late varieties largely escaped infestation. Seed cabbage may also suffer seriously if the young plants remain tender and soft for a long period, as they appear to do in years with a dry, cold spring. The larvae mined in the stalks [*cf. R.A.E.*, A **16** 415] for 5–6 weeks. After a pupal period of 3–4 weeks in the ground, some of the adults came to the surface, fed for a short time and then hibernated underground. Many, however, appeared to remain in the pupal cell until the following spring.

ZIEBARTH (F.). **Die hauptsächlichsten starken Schäden an Forstgehölzen im Jahre 1933.** [The chief severe Injuries to Forest Trees in 1933.]—*NachrBl. dtsch. PflSchDienst* **13** no. 12 pp. 103–105. Berlin, December 1933.

Records of insect pests from different localities in Germany constitute the greater part of this list.

RUŽIČKA (J.). **Altes und neues über die Nonne.** [Old and new Knowledge on the Nun Moth.]—*Sudetendtsch. Forst- u. Jagdztg* **32** pp. 150–152. Teplitz-Schönau, 1932. (Abstr. in *Neuheiten PflSch.* **26** no. 6 pp. 134–135. Vienna, December 1933.)

This paper summarises the author's observations on the nun moth [*Lymantria monacha*, L.] in Czechoslovakia. Adhesive bands are useful as an index of infestation, but are of no value for control. Healthy females oviposit on any part of the trunk, whereas those infected by polyhedral disease are unable to get far up it and even oviposit on the ground-litter, so that a concentration of eggs near the ground indicates the occurrence of the disease. The value of counts of larval excreta is reduced by the fact that they give no information regarding polyhedral disease or Tachinid parasitism. The spread of the disease can be expected only in cold, wet weather. Trees on the sunny side of stands are defoliated because the Tachinid parasite, *Phorocera* (*Parasetigena*) *silvestris*, R.-D. (*segregata*, auct.), dies out there in prolonged dry weather. Small stands of spruce withstand infestation better than large forests. Such natural enemies as birds and ants are more destructive to Tachinids than to the moth. Dusting the tree-crowns with arsenicals is advocated, even though Tachinids are also killed.

GLEISBERG (W.) & MENTZEL (F.). **Die physiologische Wirkung von Obstbaumkarbolineum. (Methodik einer allgemeinen biologischen Prüfung der Obstbaumkarbolineen.)** [The Physiological Effect of Fruit-tree Carbolineum. (Methods for a general Biological Test of Fruit-tree Carbolineums.)]—*Gartenbauwiss.* **7** pp. 711–745. Berlin, 1933. (Abstr. in *Neuheiten PflSch.* **26** no. 6 pp.140–141. Vienna, December 1933.)

The physical properties required in tar distillates for use in spraying fruit trees are ease of emulsification, on which depends the uniformity of their action, and stability of the emulsion, as the composition of the mixture is variable during the process of separation. Specific gravity and viscosity are of little practical importance. Tar distillates with the best insecticidal properties are not necessarily the most injurious to plants.

Henze (—). **Nonnenbekämpfung.** [Nun Moth Control.]—*Silva* 1932 p. 195, Tübingen. (Abstr. in *Z. PflKrankh.* **43** no. 12 pp. 692–693. Stuttgart, 1933.)

Observations in Wurtemberg showed that at least 3–4 years pass before an increase of the nun moth [*Lymantria monacha*, L.] results in defoliation, and if during this period the weather is favourable to its Tachinid parasite [? *Phorocera silvestris*, R.-D.], the latter increases more rapidly than the host and destroys it before a dangerous outbreak develops. Failing this, methodical capture of females can reduce the rate of increase of the larvae by 80 per cent. and thus keep the moth in check until the Tachinid has an opportunity of effecting control. The moths can be easily caught, as they always remain quietly settled on the tree trunks within ordinary reach. Since pairing does not take place immediately after emergence, it is possible to capture 80–90 per cent. of the females before they oviposit. As it is not possible to predict whether an outbreak will develop, methodical catching should always be carried out. For the moth, the critical period is the egg-stage, which requires warm but only moderately damp weather. The Tachinid is especially sensitive immediately after pupation in the ground, a uniform degree of soil moisture being requisite.

Ratschlag (H.). **Ertragsschäden an Winterweizen durch *Cephus pygmaeus* unter besonderer Berücksichtigung der Aussaat.** [Crop Losses in Winter Wheat due to *C. pygmaeus* with particular Regard to Sowing.]—*Fortschr. Landw.* **7** 1932 p. 265. (Abstr. in *Z. PflKrankh.* **43** no. 12 p. 699. Stuttgart, 1933.)

It has been found that the crop loss caused to winter wheat in Germany by *Cephus pygmaeus*, L., is decreased by late sowing, but the date that would ensure a satisfactory yield of grain as well as freedom from infestation by the fly had not been ascertained.

Rawitscher (F.). **Wohin stechen die Pflanzenläuse ?** [Into what do Aphids pierce ?]—*Z. Bot.* **26** p. 145. Jena, 1933. (Abstr. in *Z. PflKrankh.* **43** no. 12 p. 699. Stuttgart, 1933.)

The adult summer forms of the Aphids, *Brachycaudina napelli*, Schr., on *Aconitum napellus*, and *Doralis fabae*, Scop., on beans (*Phaseolus vulgaris*), *Hosta lancifolia* and *Clematis viticella*, pierce only the sieve-tubes of the vascular bundles. It was not possible to prove an osmotic removal of nutritious material through plasmolysis of the cells touched. Exceptional cases of injury to cells penetrated is doubtless due to poisoning by the saliva secreted in the passage pierced. The *Lachnus* of silver fir [*Abies*] also appears to pierce the sieve-tubes, and if this applies to all honey-dew Aphids, the excretion of honey-dew may be regarded as the elimination of the carbohydrates of the sieve-tube sap that the Aphid does not require. Not all sucking insects pierce the sieve-tubes ; some, such as *Phylloxera* and *Pseudococcus citri*, Risso, pierce the parenchyma cells and ligneous ones.

Plantesygdomme i Danmark 1932 [Plant Diseases and Pests in Denmark in 1932.]—*Tidsskr. Planteavl.* **39** pp. 453–511, 3 figs., 2 graphs ; also as *Overs. St. Plantepat. Forsøg* no. 49. Copenhagen, 1933. (With a Summary in English.)

Pests occurring in Denmark in 1932, in addition to some previously recorded [*R.A.E.*, A **20** 144, 655], included : *Crepidodera ferruginea*,

Scop., previously misidentified as *Phyllotreta vittula*, Redt. [**20** 144], which caused damage to oats ; *Oscinella* (*Oscinis*) *frit*, L., which infested various cereals, particularly when sown in autumn in newly ploughed grassland ; *Apion apricans*, Hbst., and *A. assimile*, Kby., which damaged red clover [*Trifolium pratense*] grown for seed [*cf.* **17** 438] ; and *A. flavipes*, Payk., which injured the leaves of white clover [*T. repens*]. *Bibio ferruginatus*, L., and *B. hortulanus*, L., which have recently caused injury to barley, have now disappeared, up to 100 per cent. of the larvae being found parasitised by a Diapriid, *Spilomicrus* sp. Swedes were attacked by *Thrips angusticeps*, Uzel, *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) and *Pieris* spp., and carrots by *Trioza viridula*, Zett., which caused leaf-curl throughout Jutland. *Anthonomus pomorum*, L., caused some injury on apple, and strawberry was attacked by *A. rubi*, Hbst., and *Peronea* (*Acalla*) *comariana*, Zell. [*cf.* **19** 274]. Larvae of the Phorids, *Megaselia* (*Aphiochaeta*) *albidihalteris*, Felt, and *M.* (*A.*) *cinerella*, Lundb., were found in cultivated mushrooms for the first time in Denmark [*cf.* **20** 369], in addition to larvae of *Sciara* spp.

Clark (P. J.). **The Determination of the Distribution of Particle Sizes in Lead-arsenate Sprays.**—*N. Z. J. Sci. Tech.* **15** no. 3 pp. 183–187, 1 graph. Wellington, N.Z., November 1933.

It is important that the size of the particles in the materials used in the control of insect pests should be standardised, so that the presence of those too large to be ingested may be avoided. This paper describes modifications of a method devised by J. H. Calbeck and H. R. Harner, in which the rate of sedimentation of a suspension is measured by means of a balance pan immersed in it. The method finally adopted gives accurate results in determining the size of particles in lead arsenate sprays.

Clark (A. F.). **The Horntail Borer and its Fungal Association.**—*N. Z. J. Sci. Tech* **15** no. 3 pp. 188–190, 2 refs. Wellington, N.Z., November 1933.

The eggs of *Sirex noctilio*, F., in conifers in New Zealand [*cf. R.A.E.*, A **20** 378] are laid about $\frac{1}{4}$ inch deep in the wood, and the larvae tunnel through the sapwood into the heartwood and sometimes even into the pith. In a study of the possible relation of this Siricid to fungi, the moisture content of 10 representative sections of wood from each of 5 heavily infested trees of *Pinus radiata* was determined by drying at a regulated temperature until no further loss in weight was recorded. It varied from 27·3 per cent. to 41·6, with an average of 34·9. When 50 small pieces of wood from the tunnels were placed on malt agar, a characteristic mycelial growth was readily obtained from 40. A similar growth was obtained from glands situated in the region of the hind-gut of the larvae and at the base of the ovipositor of the female. It appeared identical with a standard culture of *Stereum sanguinolentum* from England. The fact that the borer infests only certain trees in an unhealthy condition is probably due to its need of a medium suitable for the growth of the fungus.

Fruit Flies. The Law compels you to control them.—*Agric. Gaz. N.S.W.* **44** pt. 11 pp. 819–822, 4 figs. Sydney, 1st November 1933.

The regulations here quoted for the control of *Ceratitis capitata*, Wied., and *Dacus ferrugineus*, F. (*Chaetodacus tryoni*, Frogg.) in New South

Wales are similar to those already noticed [*R.A.E.*, A **21** 130], but include the provision that all loquats shall be removed from the trees by 30th September, and one of the bait formulae is given as $\frac{1}{8}$ fl. oz. vanilla [synthetic essence] and $\frac{1}{2}$ oz. household ammonia diluted in 26 fl. oz. water [*cf.* **20** 156]. A method of constructing a covered pit for the disposal of waste fruit [*cf.* **22** 62] is illustrated.

HELY (P. C.). **Citrus Red Scale. Experiments with liquefied Hydrocyanic Acid Gas Fumigation.**—*Agric. Gaz. N.S.W.* **44** pt. 11 pp. 823–826, 1 chart. Sydney, 1st November 1933.

An account is given of preliminary experiments on the fumigation of oranges against *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., in two localities in New South Wales in March and April 1933, using liquid hydrocyanic acid. The trees were treated at night (at 68°F. with a relative humidity of 55–60 per cent.) for 40 minutes by atomising the liquid under tents of heavy or light calico, the latter proving slightly more satisfactory. A standard dosage chart calculated on an equivalent basis to that used for calcium cyanide is appended. Dosages of 10 per cent. above and below the standard rate were tested, and compressed blocks of calcium cyanide compound were used on alternate trees for comparison. The control, as estimated from counts of the dead and living Coccids after two weeks, reached 100 per cent. when the liquid was used at or above standard strength ; at 10 per cent. below, it was equal to that obtained with calcium cyanide (over 99 per cent.). Under conditions of lower temperature (51–62°F.) and more variable humidity (41–79 per cent.), the control obtained by the various treatments, even including one in which the liquid was used at 20 per cent. below the standard, scarcely varied (99·55–99·85 per cent.).

KNOWLTON (G. F.) & JANES (M. J.). **Lizards as Predators of the Beet Leafhopper.**—*J. econ. Ent.* **26** no. 6 pp. 1011–1016, 1 ref. Geneva, N.Y., December 1933.

The following is taken from the authors' abstract : In Utah during the past three years, 2,659 lizards have been collected and their stomachs examined. Of 1,573 *Uta stansburiana* taken among food-plants of *Eutettix tenella*, Baker, 915 contained a total of 9,322 examples of the leafhopper, and of 213 *Sceloporus graciosus*, 59 contained 239. Other lizards in which one or more examples of *E. tenella* were found are *S. elongatus*, two species of *Phrynosoma* and *Eumeces skiltonianus*.

WEBSTER (R. L.). **Insect Tolerance.**—*J. econ. Ent.* **26** no. 6 pp. 1016–1021, 1 fig., 9 refs. Geneva, N.Y., December 1933.

The following is substantially the author's abstract : Reference is made to previous studies on the subject of resistance to insecticides by strains of *Aspidiotus perniciosus*, Comst. [*R.A.E.*, A **2** 378 ; **3** 758 ; **11** 417], *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., and *Saissetia oleae*, Bern. [**11** 80, **13** 511], and *Cydia* (*Carpocapsa*) *pomonella*, L. [**16** 514, **17** 365]. Spraying apples in a field laboratory in Washington State with 2 lb. lead arsenate and 1 U.S. gal. summer oil emulsion in 100 U.S. gals. water produced a uniform deposit of 0·06–0·065 mg. arsenic to a square inch of fruit surface. The average control of *C. pomonella* obtained, however, dropped from 73 per cent. in 1930 to 60 per cent. in 1931 and

36 per cent. in 1932. The same trend was evident in tests in which lead arsenate was applied without mineral oil, even though the concentration of lead arsenate was increased to 3 lb. in 1932.

SWAIN (A. F.) & GREEN (D.). **Detection and Determination of Surface Oil on *Citrus* following Spraying.**—*J. econ. Ent.* **26** no. 6 pp. 1021–1030, 1 pl., 2 graphs, 9 refs. Geneva, N.Y., December 1933.

The literature on the estimation of oil spray deposits on fruit trees is reviewed. In tests of suitable detectors, sublimed flowers of sulphur was outstandingly superior to other materials, in that it was conspicuous and, though it did not adhere to unoiled leaf surfaces, it was retained by a minute film of oil. The dust was sifted from a can or bottle covered with a cheesecloth or fine wire screen on to the surface to be tested, which was then inverted and shaken. After a repetition of this process, any loosely held powder remaining was blown off. The presence of dust on the leaves did not interfere with the test, though it should not be made when the foliage is wet. The amount of dust retained could be used to indicate visually differences in amounts of oil of a ratio of 1 : 2 or greater, provided that the lightest deposition checked did not exceed about 30 mg. to 100 sq. cm. As the oil absorption rate of different parts of a tree varies greatly, deposits on them should be compared as soon as possible after the moisture from the spray has evaporated. When leaves taken from two groups sprayed simultaneously with approximately equal amounts of oil, one on the lower and the other on the upper surface, were tested by this method, the deposit of oil remaining immediately after treatment was one-third less on the lower than on the upper surface ; after 6 hours hardly any oil remained on the lower surface, whereas on the upper surface the deposit had only decreased slightly after 8 hours and traces remained for more than 10 days.

A practical method for quantitative determinations of oil films on *Citrus* foliage, was developed by the authors from one originated by A. L. Pittman and E. W. McGovern. The surfaces to be tested, are washed with a solvent (methylene chloride being the most satisfactory), and the solution is filtered. The solvent is then evaporated on a water bath maintained at 45°C., and the dish is dried in an oven at 45–50°C. for 2 hours and then cooled in a desiccator. The residue is calculated in milligrams of oil per 100 sq. cm. of surface. Samples must not be washed with solvent until they have been first dried from spray treatment (1–2 hours after spraying under ordinary field conditions), and should be taken from not less than 10 individual leaves yielding not less than about 30 milligrams of oil. In order to avoid disturbing the waxy coating of the leaf, a special type of wash bottle was devised, which is described. It produced a fine stream of solvent, broken into a flat, fan-shaped spray, that facilitated rapid and thorough washing without destroying the wax. This method can be used to determine the total oil deposited by petroleum insecticides, provided that the determination is made before any appreciable amount of the oil has penetrated into the plant tissues, samples being taken preferably from the upper surface. The portion of original oil remaining as an effective insecticide at any given time, or the amount of oil retained by varying types of surface, can also be readily determined.

The surface area of fruit or wood was calculated from the average maximum and minimum circumference measurements, and that of

leaves according to a formula (based on measurements of over 200 leaves) that expressed the relation between the area of a normal leaf and the product of its length and width.

Pratt (F. S.), Swain (A. F.) & Eldred (D. N.). **Study of Auxiliary Gases for increasing the Toxicity of Hydrocyanic Gas. Part I. Studies with Ladybird Beetles as Indices of Toxicity.**—*J. econ. Ent.* **26** no. 6 pp. 1031–1041, 1 pl., 12 graphs, 7 refs. Geneva, N.Y., December 1933.

The following is taken mainly from the authors' abstract : Almost 200 chemicals, covering a wide range of organic and inorganic compounds, were tested to determine the action of their vapours on Coccinellids (chiefly *Hippodamia convergens*, Guér.) in conjunction with hydrocyanic acid gas.

Several were toxic in themselves, such as cyanogen chloride, hydrogen chloride, thionyl chloride and camphor, but few approached HCN in toxicity. Some, such as salicyl aldehyde, were extremely irritating to the insects, and some, such as carbon dioxide, were stupefying. In general, those that increased the toxicity of HCN, the best of which in order of effectiveness were salicyl aldehyde, benzaldehyde, ethyl thiocyanate, allyl isothiocyanate, thiophenol, benzyl bromide and perchlormethylmercaptan, were either predominantly toxic or moderately toxic and irritating. The majority fell in the latter class. Certain of the gases that stupefied the insects actually decreased the toxic action of HCN ; the addition of carbon dioxide (1 or 10 per cent.), which has been shown by other workers to increase the toxicity of certain fumigants [*R.A.E.*, A **17** 80, 560] to other insects, decreased the toxicity of HCN to *Hippodamia*, possibly owing to "protective stupefaction" [*cf.* **18** 41 ; **20** 32]. Although the vast bulk of the compounds tested had no apparent effect, the studies suggest that the toxicity of HCN can be decidedly enhanced by the use of auxiliary gases, particularly salicyl aldehyde, of which both man and plants appear to be quite tolerant.

Lehman (R. S.). **Laboratory Experiments with various Fumigants against the Wireworm** *Limonius* (*Pheletes*) *californicus* **Mann.**—*J. econ. Ent.* **26** no. 6 pp. 1042–1051, 1 pl., 14 graphs, 9 refs. Geneva, N.Y., December 1933.

An investigation is described in which 13 fumigants, most of which had previously given 100 per cent. mortality of *Calandra* (*Sitophilus*) *oryzae*, L. [*R.A.E.*, A **18** 689], were tested against *Pheletes* (*Limonius*) *californicus*, Mann., and their median lethal concentrations (50 per cent. mortality point) determined under controlled conditions and compared with that of carbon bisulphide. Methods used by other workers in comparing fumigants are discussed, and their inaccuracies are pointed out [*cf.* **20** 60]. In all tests, the time of exposure to the fumigant was 5 hours, the concentration being the variable factor. The wireworms were suspended in wire baskets inside the flasks containing the fumigant and examined immediately after exposure and subsequently at intervals during 60 days. Of those exposed to a constant volume of ethylene chlorohydrin dissolved in various amounts of ethyl alcohol, more were killed when the proportion of the solvent was less ; when, however, distilled water in various proportions was used as the solvent, the mortality remained constant. As ethyl alcohol appeared to have little effect

on the larvae when used alone or as a solvent for other compounds, it is not likely that the effect produced was anaesthetic, but an adequate explanation of the phenomenon is lacking. Chloropicrin appeared to affect the nervous system of the wireworms, as although unable to walk, they retained the power to twist and roll ; their legs were not paralysed, and they remained alive but still incapable of walking or feeding two months after exposure. The median lethal dose (in mg. per litre) of carbon bisulphide was 31·5 ; the most toxic fumigants tested were allyl isothiocyanate (0·16), ethylene chlorohydrin (0·24) and chloropicrin (0·69). Some of those shown in these tests to be much more effective against wireworms than carbon bisulphide in air have, however, proved less effective in soil.

HERBERT (F. B.). **Airplane Liquid Spraying.**—*J. econ. Ent.* **26** no. 6 pp. 1052–1056, 4 pls. Geneva, N.Y., December 1933.

Two methods of applying liquid sprays by aeroplane have been in use for about 18 months and have proved satisfactory. In the first, a steel bristle rotary brush is driven by a small propeller ; the spray oil flows by gravity to the centre of the brush, and centrifugal pumps force it out through spacers to the bristles. In the second, the oil flows by gravity into hollow three-bladed propellers and through jets set in small venturi tubes near the tips of the blades. Both devices break it into a fine mist. As water solutions were found to evaporate before coming in contact with the plants, the oil is not diluted, but it is made miscible so that it will not be repelled by moisture with which it may come in contact, and will have greater creeping power. Oils may be used for scale control or may carry other insecticides, such as nicotine or pyrethrum. The aeroplanes travel at 80–110 miles an hour, and the "rotors" are capable of throwing out the spray at rates of from 5 to 80–100 U.S. gals. a minute. From 2 to 15 U.S. gals. to the acre can be evenly distributed, the average required being 4–10. The aeroplane flies 2–4 ft. above the tops of the plants, spraying one row of trees at a time in an orchard, or covering a strip 30–40 ft. wide of vines, cotton or vegetable crops. With allowance for loading, which with the aid of rotary pumps driven by motors or batteries usually occupies about 2 minutes, it can apply the spray on 35–60 acres an hour. Individual acres have been covered in 7 seconds. The fine mist of oil floats downward as the aeroplane compresses the air below it and then rebounds while the wash of the machine starts it rolling. It spreads laterally 40–75 ft. from the centre of the aeroplane. Although the upper surfaces of leaves receive the heavier film of oil, many droplets form on the lower surfaces and diffuse slowly, giving adequate coverage.

The advantages of this method are : speed of application ; ease of treating moist ground ; avoidance of injury to plants covering the surface of the ground ; greater potency of the form in which the materials are applied ; absence of loss from wind (as compared with dusts) after application ; and smaller cost of hiring aeroplanes as compared with buying equipment. On the other hand, aeroplanes are handicapped by windy weather, and coverage of trees with heavy foliage such as *Citrus* may not prove adequate. Materials applied by aeroplane, being of a higher grade than those applied from the ground, cost rather more, but the quantities required are smaller.

A list of some of the insects and fungi successfully treated by aeroplane is given, with notes on proprietary spray materials used.

Although variable, the results obtained have been fully as satisfactory as those secured from ground applications. Almost 100 per cent. control of brown apricot scale [*Lecanium corni*, Bch.] was obtained in California with miscible oil on prunes and apricots, and satisfactory control of pear thrips [*Taeniothrips inconsequens*, Uzel] on prunes with oil and nicotine. Overwintering adults of the grape leafhopper [*Erythroneura comes*, Say] were adequately controlled on vines with a mixture of pyrethrum, nicotine and light oil at 4 U.S. gals. to the acre ; this dosage will have to be increased slightly for nymphs in June, when the foliage is more abundant. Preliminary work on onion against onion thrips [*Thrips tabaci*, Lind.] indicates that it will be controlled by aeroplane more satisfactorily than by any other method.

Newcomer (E. J.), Rolfs (A. R.) & Dean (F. P.). **A practical Test of chemically treated Bands for the Control of the Codling Moth.**— *J. econ. Ent.* **26** no. 6 pp. 1055–1058. Geneva, N.Y., December 1933.

The percentage of apples infested with *Cydia* (*Carpocapsa*) *pomonella*, L., in an orchard in Washington State increased from 11·6 in 1930 to 20 in 1932 on trees protected with beta-naphthol bands, and from 11 to 33·5 on unbanded control trees, all blocks having received one calyx and six cover sprays of the same materials each year. Records made in 1931 and 1932 showed that an average of 50 per cent. of the larvae that left the fruit were caught in the bands. As the percentage of larvae that had left the apples when they were picked was only about 20 in September and 35 in October, all apples should be promptly removed from the orchard when picked and infested ones used or destroyed.

Brindley (T. A.). **Some Notes on the Biology of the Pea Weevil *Bruchus pisorum* L. (Coleoptera, Bruchidae) at Moscow, Idaho.**— *J. econ. Ent.* **26** no. 6 pp. 1058–1062, 2 figs., 4 refs. Geneva, N.Y., December 1933.

Observations on *Bruchus pisorum*, L., in Idaho showed that besides those adults that hibernate in hedgerows, under pine bark, in old buildings, etc., a certain number hibernate among refuse in the pea fields [*cf. R.A.E.*, A **20** 24, 683]. Under a cage placed at random in a field in spring, 8 overwintered beetles emerged from an area of 12 sq. ft. The beetles emerge about the time that the peas come into bloom, but do not appear in large numbers until a few days later. After feeding for about a week on the pollen of the pea flower [**19** 578], they pair and oviposit. Though the females lay their eggs on pods of all sizes, they prefer those that have reached their maximum growth but still remain succulent. As many as 126 eggs have been observed on one pod. The pods remain suitable for oviposition as long as 18 days, and pea plantings as a whole produce suitable pods over a period of 25 days. Contrary to results recorded by other workers [**16** 219], the number of eggs laid by individuals is large, a maximum of 735 and an average of 432 being recorded for 12 pairs studied. The young larva on hatching bores through the egg at the point where it is attached to the pod, enters the pod and finally the pea. Often it does not make its way directly into the seed, but mines in the wall of the pod before entering the interior. Although several larvae and as many as two adults have

often been found in the same seed, only one emerges alive. The larval development was studied by instars, and the results are tabulated. The average length of the stages, based on data secured by splitting peas at 2-day intervals, was: egg, 8·7 days; larva, 41·7; pupa, 13·7. In autumn, the adults leave the ripe peas, not coming out in large numbers until rain has fallen, and seek hibernation quarters. This Bruchid lived much longer than previously reported, 11 per cent. from peas of the 1931 crop being still alive on 28th May 1933 and likely to produce eggs.

Larson (A. O.), Brindley (T. A) & Hinman (F. G.). **The local Dispersal of the Pea Weevil.**—*J. econ. Ent.* **26** no. 6 pp. 1063–1068, 2 figs., 3 refs. Geneva, N.Y., December 1933.

Bruchus pisorum, L., which has only one generation a year and hibernates as an adult in the pea on which it has fed as a larva or in some other suitable place [see preceding paper], may leave the pea as soon as it is ripe or a few weeks later or, if undisturbed, remain semi-dormant within it for an indefinite period. The search for winter quarters, which can be observed in heavily infested fields shortly after harvest, is hastened by rainstorms, which cause most of the adults remaining in peas on the ground to seek shelter. They can apparently fly several miles [*cf. R.A.E.*, A **16** 219]; an 80 per cent. infestation in a neighbourhood where peas had been grown for the first time could have originated only from one field a mile away or another two miles distant. Observations over two years in Oregon indicate that they sometimes fly on warm days in winter. After leaving their shelters in spring, they stay on leaves and grasses for a few days before migrating to the pea fields, where they remain in hiding within the blooms or leaf-buds on cold days. Infestation is generally heaviest at the edges of fields and on the sides adjoining dense woods or bushes, which are favourable hibernation quarters. In hilly country in Idaho, infestation was twice as heavy in hollows that provided sheltered winter quarters as on ridges. Densely sown peas are less heavily infested, and any part of a field left unharvested on account of thickness of weeds or thinness of plants will usually prove a prolific source of infestation for next year's crop. The Bruchids remain unevenly distributed until most of their eggs have been deposited, but after the blossoms have disappeared and the pods have begun to wither, shortage of food causes a further migration, after which they appear to be more generally distributed over the field as well as over weeds in adjacent fields and pastures. In western Oregon, all adults leave the pea fields before harvest and do not appear to return to them for hibernation. They have been found feeding on the pollen of numerous wild flowers, one more than half a mile from the nearest pea field, and apparently soon die.

Mail (G. A.) & Salt (R. W.). **Temperature as a possible limiting Factor in the Northern Spread of the Colorado Potato Beetle.**—*J. econ. Ent.* **26** no. 6 pp. 1068–1075, 1 map, 5 refs. Geneva, N.Y., December 1933.

The history of the spread of *Leptinotarsa decemlineata*, Say, in the United States and to Canada is briefly reviewed. The two chief barriers to its northward spread were probably lack of suitable foodplants and low winter temperatures. Since potatoes are cultivated extensively in the areas immediately to the north of the most northerly

points already reached by the beetle, the important factor limiting its further spread will probably be found to be winter temperatures.

Experimental data on the resistance of the beetle to low temperature showed that the undercooling point of hibernating beetles varied from —4·3 to —11·6°C. [24·26–11·12°F.], with an average of —7·3°C. [18·86°F.]. The absolute minimum lethal temperature was coincident with the undercooling point. The mortality should vary, therefore, from 0 at —4°C. [24·8°F.] to 100 per cent. at —12°C. [10·4°F.], while —7°C. [19·4°F.] is low enough to kill most of the beetles.

Winter soil temperatures in Minnesota are such that it is doubtful whether hibernating beetles within two feet of the surface would survive unless the soil were covered with snow. In the latter case, even the soil surface temperature does not usually drop much below freezing point, so that any mortality in hardened beetles is highly improbable. The minimum soil temperatures at Beaver Lodge, north-western Alberta, during 3 years were —10·6, —11·1 and —11·1°C. [12·92 and 12·02°F.], so that a very high percentage of mortality can be expected. Actually, the beetle is not present there, and it appears reasonable to assume that the winter soil temperature is the limiting factor.

Felt (E. P.). **The Chinese Mantid.**—*J. econ. Ent.* **26** no. 6 p. 1075. Geneva, N.Y., December 1933.

Paratenodera sinensis, Sauss. [*cf. R.A.E.*, A **16** 506], which was found to be present in Connecticut in 1930, when it was probably also already distributed over certain localities in western Long Island, has become steadily more numerous in both areas during the past three years, the winters having been mild.

Shull (W. E.). **The Identity of two *Lygus* Pests (Hemiptera, Miridae).**—*J. econ. Ent.* **26** no. 6 pp. 1076–1079, 6 refs. Geneva, N.Y., December 1933.

Lygus hesperus, Knight, was originally described as a variety of *L. elisus*, Van Duzee, but both have more recently been regarded by Knight as varieties of *L. pratensis*, L. Recent investigations by the author, however, have shown certain differences indicating that they are distinct species. Incomplete data concerning the food-plants suggest a possible variation in range, and the two species were found not to interbreed, whereas the offspring of pairs of either had the same specific characters as the parent insects. Characters distinguishing the two species are given. Both are known to breed on lucerne and clover throughout their range in the western United States, and *L. elisus* has been recorded as puncturing beans in Idaho [*R.A.E.*, A **19** 364].

Rice (P. L.). **Insects collected in Flight Traps in the Vicinity of Moscow, Idaho.**—*J. econ. Ent.* **26** no. 6 pp. 1079–1083, 1 pl. Geneva, N.Y., December 1933.

Traps consisting essentially of a screen so arranged that insects striking it in flight fall through a funnel into a can were operated in different types of localities and suspended at different heights. During two years, data on the occurrence and flight habits of approximately 500 species were obtained, of which two-fifths were Coleoptera and one-fifth Hymenoptera.

Thompson (B. G.) & Kwan Lun Wong. **Western Willow Tingid, *Corythucha salicata* Gibson, in Oregon.**—*J. econ. Ent.* **26** no. 6 pp. 1090–1095, 1 fig., 3 refs. Geneva, N.Y., December 1933.

Corythucha salicata, Gibson, has been abundant on apple in several orchards in Oregon during the past few years and scarce on willow, which is supposed to be its chief food-plant, even when growing in infested orchards. All stages of this Tingid are described and its distribution discussed. Loss in a heavily infested orchard was estimated at practically the whole crop. Feeding by adults and nymphs causes the foliage to become brown and withered and sometimes leads to complete defoliation by mid-July.

Preliminary observations show that from 50 to 528 eggs are deposited singly and at random on the lower surface of a leaf, usually along both sides of the ribs. The tissue surrounding the eggs is somewhat hard and corky, and where many are laid on one leaf, the ribs may be distorted. They are laid from the end of April till the beginning of July and probably hatch in about 3 weeks. The nymphal stage lasts 19–29 days. The nymphs are gregarious in the first two instars and do not move far from the scene of hatching, but become active in the third. All five nymphal instars may be found in the field from the middle of June until the end of July. The adults are also gregarious in habit. Both nymphs and adults feed on the lower surface of the leaves, which, however, show discoloration of both surfaces. The adults hibernate chiefly among moss on standing trees in or near the orchard, and more rarely in rubbish on the ground or under the bark of trees. Damage to apple in Oregon has only been observed in orchards adjacent to woods (usually of oak) heavily covered with moss, infestation always beginning on trees next the woods. The overwintered adults emerge on warm days in spring; in the district in which infestation was most severe, an average of 10 and a maximum of 112 were found in single apple buds immediately after emergence, which is quickly followed by feeding and pairing. Eggs were laid about 3 weeks later. There is apparently one generation a year. Adults of the new generation were observed from the middle of June to August.

In preliminary control tests, the most effective spray killed only 50 per cent. of the overwintering adults. Nymphs were killed readily with all those tested, which included oil emulsion, pyrethrum extracts, nicotine sulphate, and fish-oil soap.

Elmore (J. C.). **Some Tests with Fluorine Compounds against the Pepper Weevil *Anthonomus eugenii* Cano.**—*J. econ. ent.* **26** no. 6 pp. 1095–1105, 5 figs. Geneva, N.Y., December 1933.

In tests of dusts for the control of *Anthonomus eugenii*, Cano, on pepper [*Capsicum*] in California, sodium fluoaluminate, potassium fluoaluminate, and barium fluosilicate, each mixed with 50 per cent. talc, and calcium arsenate [*cf. R.A.E.*, A **17** 717] at full strength, when applied under controlled cage conditions with a known number of adult weevils, gave percentage mortalities after 72 hours of 94·4, 82·7, 71·1 and 90–90·4 respectively. Barium fluosilicate at 80 per cent. concentration gave 95 per cent. mortality, but scorched the leaves and caused stunting and yellowing of the plants. Plants dusted with sodium fluoaluminate in the presence of moisture showed injury to leaves and buds, but did not appear unusually yellow or retarded in growth.

Both barium fluosilicate and sodium fluoaluminate caused crop reduction in field plots in 1931. Of the fluorine compounds that gave satisfactory control, potassium fluoaluminate was the least injurious to the plants. In a dry atmosphere under greenhouse conditions, barium fluosilicate was the only fluorine compound that caused definite injury. Sodium fluoaluminate caused less injury in the greenhouse on wet plants when combined with a small quantity of silicon dioxide. In view of the injury to plants and the residue problem, the use of these fluorine compounds is not recommended.

Borden (A. D.). **Efficient Agitation in the Spray Tank.**—*J. econ. Ent.* **26** no. 6 pp. 1106–1108, 1 fig. Geneva, N.Y., December 1933.

The following is substantially the author's abstract: In testing over 200 spray outfits, the agitation in the spray tank was found to be decidedly inefficient. It is recommended that a new type of square-ended agitator, which gives excellent results at speeds of between 88 and 110 r.p.m. produced by low-powered motors (2·5 to 8 h.p.), should replace those of the propeller type, which do not give a uniform mixture at speeds of less than 200 r.p.m.

Allen (T. C.) & Fluke, jr. (C. L.). **Notes on the Life-history of the Apple Maggot in Wisconsin.**—*J. econ. Ent.* **26** no. 6 pp. 1108–1112, 3 graphs, 3 refs. Geneva, N.Y., December 1933.

Observations in Wisconsin in which apples infested with *Rhagoletis pomonella*, Walsh, were kept in field cages showed that over 37 per cent. of the flies from pupae formed in 1930 emerged in 1932. Their maximum emergence occurred on 4th August, and that of flies from one-year-old pupae on 27th July. The application of two sprays, the second 8–12 days later than the first, is therefore recommended in seasons when the flies emerging from two-year-old pupae are likely to be numerous. Lead arsenate (1 lb. to 50 U.S. gals. lime-sulphur spray) was effective when thus applied. The large proportion of delayed emergence from pupae formed in 1930 was doubtless due to the abnormally hot and dry summer of 1931. In rearing the flies, yeast dried at 70–80°F., powdered and mixed with 3–4 parts of honey proved considerably more successful for feeding the adults than did yeast and honey to which water was added [*R.A.E.*, A **19** 342]. Water has to be supplied separately, but its use in the mixture leads to fermentation.

Thompson (F. M.) & Worthley (H. N.). **Field Studies with Pine Oils as Destroyers of overwintering Codling Moth Larvae.**—*J. econ. Ent.* **26** no. 6 pp. 1112–1117, 1 pl. Geneva, N.Y., December 1933.

As a result of a study of various steam-distilled pine oils, a formula consisting of a blend of several fractions with a heavy non-volatile oil as base was finally developed, which when brushed liberally upon the rough bark, crotches, pruning wounds and cankers of apple trees proved toxic to the hibernating larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., without injuring the trees [*cf. R.A.E.*, A **21** 223]. It is soaked up by the cocoons and kills the larvae in them by contact. It may be applied with a long-handled round brush, 3 inches in diameter, with bristles 2–3 inches long. It is important that the areas treated should be thoroughly wetted and that the oil should not be applied to new pruning

wounds or buds. After the use of this material on several hundred trees in New Jersey and Pennsylvania in the spring of 1932, the percentage of apples injured by the first brood was from 33 to 66 per cent. less on treated trees than on controls.

North (H. F. A.) & Thompson (G. A.). **Investigations regarding Blue Grass Webworms in Turf.**—*J. econ. Ent.* **26** no. 6 pp. 1117–1125, 2 refs. Geneva, N.Y., December 1933.

In view of the unusually severe injury recently caused to turf on golf courses by webworms (*Crambus* spp.) [*R.A.E.*, A **21** 457, etc.], a number of insecticides were tested during 1930–32 on infested putting greens in Rhode Island, where the species of importance was *C. teterrellus*, Zinck. (blue-grass webworm). *Agrostis canina* suffered more severely during 1931 and 1932 than any other species of bent grass, and some varieties of it more severely than others. The damage was reduced considerably by lead arsenate, Paris green or a commercial soil insecticide, moderately by dilute pyrethrum extracts or an extract of rotenone, and slightly by kerosene emulsion. Lead arsenate (2 lb. in 20 U.S. gals. water to 1,000 sq. feet of turf) is regarded as a very promising remedy.

Calhoun (P. W.). **Irregularity among Cotton Plants in Time of Fruiting as a Factor affecting Susceptibility to Damage by the Cotton Weevil.**—*J. econ. Ent.* **26** no. 6 pp. 1125–1128, 1 fig. Geneva, N.Y., December 1933.

A considerable variation in the date of fruiting of different cotton plants growing together, whether due to environmental or to varietal differences, would obviously lead to greater damage by *Anthonomus grandis*, Boh., for the few early plants would serve as breeding-places for weevils that would migrate to the later plants before the bolls on the latter had matured. Of 600 plants observed in a field in Florida, the very earliest blossomed 12 days earlier than the last half, maximum frequency of blossoming occurring on the 11th day. In an entirely uninfested field, the half of the plants that blossomed earlier might be expected to produce more cotton than the later ones; as, however, a large proportion of the plants that actually produced an average number of bolls began to fruit 9–10 days later than the earliest 10 per cent., the presence of the few very early plants would, in a heavily infested field, have reduced the crop rather than increased it.

Bedard (W. D.). **The Number of Larval Instars and the approximate Length of the Larval Stadia of *Dendroctonus pseudotsugae* Hopk., with a Method for their Determination in Relation to other Bark Beetles.**—*J. econ. Ent.* **26** no. 6 pp. 1128–1134, 2 figs., 2 refs. Geneva, N.Y., December 1933.

In the course of a study in Idaho of the Braconid, *Coeloides brunneri*, Vier., the most valuable larval parasite of *Dendroctonus pseudotsugae*, Hopk., in Douglas fir [*Pseudotsuga taxifolia*], the importance of ascertaining the habits of the Scolytid larvae under the bark became apparent, and a method was devised whereby it was hoped that daily observations could be made to determine the number and duration of their instars. Adult females were allowed to construct galleries in thin

sheets of inner bark held between two sheets of window glass, the bark being pared so thin that they had just enough room to work between the plates while yet remaining visible at all times. To prevent excessive drying of the bark, cotton was placed between the plates and moistened daily. The plates were then wrapped in a black cloth to exclude light. Eggs laid by these females hatched successfully, and the resultant larvae were observed daily in the tunnels until (during the second instar) they disappeared in the bark. Thinner pieces of material dried rapidly, and larvae transferred to them died. From measurements of head capsules of the first, second and last instar and the application of Dyar's law [*cf. R.A.E.*, A **17** 178], checked by measurements of a large number of additional head-capsules, the number of instars was determined as five. Their average duration, as estimated by averaging the intervals between the first (and also the last) findings of successive instars in daily collections, was 6, 13, 16, 16 and 17 days respectively. Measurements of 200 capsules found clinging to hibernacula of *C. brunneri* showed that only fourth-instar larvae, which do not appear until the middle of July, and a few of the fifth instar had been parasitised.

Attacks by *D. pseudotsugae* begin early in May, and *C. brunneri* emerges about two months later, when the host larvae in the newly attacked trees are at the stage preferred for oviposition. Decking and burning infested logs in autumn, which is the method of control at present followed, destroys the parasite as well as the host, whereas if the work was carried out during June and early July, the former would escape destruction. Owing to risk of fire in certain areas, however, this arrangement cannot be generally recommended, and it has not been determined whether the advantage secured by preserving the parasite will compensate for the numerical increase of the beetles if autumn control is omitted and the spring attack allowed to develop before control is undertaken.

JEWETT (H. H.). **The Resistance of Leaves of Red Clover to Puncturing.** —*J. econ. Ent.* **26** no. 6 pp. 1135–1137, 1 fig., 1 ref. Geneva, N.Y., December 1933.

In a study in Kentucky of the susceptibility of different strains of red clover [*Trifolium pratense*] to injury by *Empoasca fabae*, Harr., 500 leaves of each of two strains, one resistant and the other susceptible, were punctured with a specially devised instrument with a very fine needle. In the case of the resistant strain, a greater pressure was required to drive the needle through the leaf.

DRIGGERS (B. F.). **Fruit Injury on Apples following Nicotine Tannate Sprays.**—*J. econ. Ent* **26** no. 6 pp. 1137–1139, 1 ref. Geneva, N.Y., December 1933.

The following is mainly taken from the author's abstract: A peculiar type of injury consisting of corky dark-brown spots on the fruit, usually on the lower surface where spray residue was concentrated, was observed in New Jersey on apples sprayed with nicotine tannate [*R.A.E.*, A **20** 677] for the control of the codling moth [*Cydia pomonella*, L.]. This injury was not observed on three varieties of apple sprayed with nicotine tannate four times during July and August, and observations indicate that it occurs only when the fruit is young.

There is evidence that an excess in the early cover sprays of free nicotine, which tends to combine with any free tannic acid in the spray tank, will reduce the danger of injury.

MOORE (W.). **Studies of the " resistant " California Red Scale *Aonidiella aurantii* Mask. in California.**—*J. econ. Ent.* **26** no. 6 pp. 1140–1161, 3 graphs, 12 refs. Geneva, N.Y., December 1933.

In the early stages of fumigation of *Citrus* with hydrocyanic acid gas, failure to control scale insects was considered to be due to faulty work or equipment. More recently, numerous workers have suggested that there is a biological race of *Aonidiella aurantii*, Mask., able to withstand even more than 100 per cent. dosages of hydrocyanic acid, or that the scale is more difficult to control in certain areas, under special conditions or in particular situations [*R.A.E.*, A **11** 80 ; **13** 511 ; **20** 175 ; **21** 606, etc.]. A preliminary study has now been made of the factors affecting control of *A. aurantii* with this fumigant. It has been suggested [**20** 382] that density of scale population may be an important factor, but in counts on lemons in two fumigated orchards where infestation varied from under 100 to over 400 per fruit, the percentage of control obtained was constant (96·18–97·63).

Each of the experiments here described was made with densely infested lemons, involving from 5,000 to 20,000 scales. An idea persists among fumigators and growers in California that a better result would be obtained by reverting to old materials and methods, by which the gas was generated more gradually. In a comparative study, however, the type of concentration curve had no decided influence on mortality provided that there was a good distribution of gas ; a low concentration gradually built up and maintained and a quick high concentration rapidly leaking away gave similar results. Under unfavourable conditions, satisfactory kills cannot be obtained merely by raising the concentration or increasing the time of exposure.

Unpublished studies by several workers have indicated that certain stages (particularly the late second moult and the early grey adult) of the so-called resistant scale are more difficult to kill than others. Tests under actual orchard conditions showed that, although the proportion of resistant stages does not determine the effectiveness of the fumigation, it probably determines which insects will survive in an unsuccessful fumigation.

In tests with lemons from different localities, infested with resistant and non-resistant strains respectively, high temperature and low relative humidity increased the resistance of the former. The scales were often more difficult to kill where the temperature of the lemon was higher than that of the air. Very low temperatures shortly following fumigation also tended to reduce mortality. Preliminary fumigation of infested lemons, in laboratory and field tests, with 0·015–0·02 per cent. HCN by volume for 20 minutes to produce " protective stupefaction " [**18** 41] did not invariably reduce mortality in subsequent treatment and sometimes actually increased it.

It appears from the data so far accumulated that the difficulty involved is that of reaching the Coccid through its scale rather than of overcoming any distinct immunity of the insect itself. Under conditions favourable to the absorption or adsorption of the gas, resistant and non-resistant strains may be killed equally well, whereas under conditions unfavourable to absorption but favourable to the action of

HCN on the tissues of the Coccid, the mortality of resistant strains is reduced appreciably but that of non-resistant strains little if at all. Such conditions are : previous exposure to low concentrations, high temperature and low relative humidity during fumigation, and low humidity preceding, or low temperatures following, fumigation.

Hockenyos (G. L.). **The Mechanism of Absorption of Sodium Fluoride by Roaches.**—*J. econ. Ent.* **26** no. 6 pp. 1162–1169, 1 ref. Geneva, N.Y., December 1933.

Sodium fluoride was applied to various parts of the body of cockroaches (*Periplaneta americana*, L., and *Blatta orientalis*, L.) closely confined in bronze fly-screen cages so as to prevent them from removing the material. The data obtained, supplemented by dipping tests, indicate that the fluoride can be absorbed in lethal amounts directly through the body integument, especially where the chitin is thin and flexible. As, however, the coefficient of absorption is apparently rather low and the fluoride dust as ordinarily used does not come in contact with the most effective areas, it is not likely that direct absorption is of great importance in control. Neither a very finely powdered sodium fluoride dust (which was much more readily absorbed than a coarser product) nor a saturated water solution was taken up by the tracheal system in a quantity sufficient to cause death. Enough fluoride was not swallowed in washing the antennae to cause death, but if the tarsi were all covered with the fluoride, enough was sometimes taken in by way of the mouth. Fluoride accumulating on the palps was apparently not sufficient to cause death.

Common Names of Insects approved for general Use by the American [Association of] Economic Entomologists.—*J. econ. Ent.* **26** no. 6 pp. 1169–1170. Geneva, N.Y., December 1933.

This first supplement to the recent list of popular names of insects approved by the Association [*R.A.E.*, A **20** 142] contains 28 names.

Hutson (R.). **Pyrethrum Solutions for determining Insect Infestation on Golf Greens.**—*J. econ. Ent.* **26** no. 6 p. 1171. Geneva, N.Y., December 1933.

A survey of golf greens in Michigan reported to be injured by sod webworms [*Crambus*] was made by soaking unit areas of the greens with a solution of pyrethrum (approximately 0·001 per cent. pyrethrins), which caused the insects hidden about the roots of the grass to come to the surface. About 50 per cent. of the injury caused was found to be due to cutworms, which were effectively controlled by applications of poisoned bran bait.

Clancy (D. W.). **Long-tailed Mealybug abundant on Citrus.**—*J. econ. Ent.* **26** no. 6 p. 1171. Geneva, N.Y., December 1933.

Pseudococcus adonidum, L. (*longispinus*, Targ.), hitherto considered to be primarily a greenhouse pest, has been known to occur on *Citrus* in small numbers in California for a number of years, but has now become sufficiently abundant to require special attention over an area of 200 acres. The injury caused is, however, limited to the presence of sooty

mould on the leaves. As *Cryptolaemus montrouzieri*, Muls., the predator used successfully in the control of all other mealybugs in this district, refuses to attack *P. adonidum*, tent fumigation with hydrocyanic acid gas was tested against it with excellent results.

ROSENFELD (A. H.). **The European Corn Borer in Egypt.**—*J. econ. Ent.* **26** no. 6 pp. 1171–1172. Geneva, N.Y., December 1933.

Pyrausta nubilalis, Hb., although first reported from Egypt in 1912 [*R.A.E.*, A **1** 501] on some ears of maize, probably purchased from a street vendor in Alexandria, has never been known to cause actual damage there to maize, which is one of the principal crops. In July 1933, however, a single individual was bred from maize grown near Alexandria, and in August the first appreciable infestation of about 5 per cent. in the upper portion of some maize plants was recorded from Damietta.

WOLCOTT (G. N.). **Otiorhynchids oviposit between Paper.**—*J. econ. Ent.* **26** no. 6 pp. 1172–1173. Geneva, N.Y., December 1933.

Strips of paper (8–10 by 2–3 ins.), clipped round the tops of stakes supporting seedling *Citrus* trees so that the two long loose ends are opposite each other were found in Porto Rico to constitute effective automatic traps for the eggs of *Diaprepes abbreviatus*, L., the females of which show a strong preference for ovipositing between the ends of the strips rather than normally between the leaves of their food-plants [*cf.* *R.A.E.*, A **11** 59]. A similar preference was shown by *Lachnopus curvipes*, F., which was also found ovipositing on *Citrus* in Porto Rico, and, in captivity, by *Exophthalmodes* (*Prepodes*) *roseipes*, Chevr., and it is probably common to similar beetles found elsewhere in the West Indies. The newly-hatched larvae are unable to emerge from between the strips of paper, which are closely stuck together by the ovipositing weevils, and eventually dry up and die. In the tropics, the traps remain effective for at least three months, if made of thin, tough wrapping paper.

TATE (H. D.). **Notes on Potato Insects in Iowa.**—*J. econ. Ent.* **26** no. 6 p. 1173. Geneva, N.Y., December 1933.

Phthorimaea operculella, Zell., which has apparently not been previously recorded from Iowa, is reported from potato in various localities in the eastern half of the State, where it seems to have been established for some years. The larvae were first observed in June 1933 mining potato foliage and quite frequently entering the petioles; they are also reported as occurring in stored potatoes. Many were parasitised by an Ichneumonid. The weevil, *Trichobaris trinotata*, Say (potato stalk-borer), which is present each year in Iowa, although serious outbreaks are sporadic, infested more than 75 per cent. of the plants in some fields in 1933, of which 10 per cent. gradually wilted and died early in July. The Capsids, *Chlamydatus associatus*, Uhl., and *Campylomma verbasci*, H.-S., which have not previously been associated with potato in Iowa, were abundant throughout the early part of the summer. Their relation to this food-plant and the damage caused by their feeding and oviposition have not been definitely established, but all stages (including the eggs) of both species have been obtained

in large numbers from potato. Owing to its natural food-plants having been destroyed by drought or cultivation, the false chinch bug [*Nysius ericae*, Schill], which occurred in destructive numbers in many parts of Iowa in 1932–33, caused occasional injury to potato foliage.

BARBER (G. W.). **On the Probable Reason for the Scarcity of the Southern Corn Stalk Borer (*Diatraea crambidoides* Grote) in south-eastern Georgia.**—*J. econ. Ent.* **26** no. 6 p. 1174. Geneva, N.Y., December 1933.

Diatraea crambidoides, Grote, was very scarce in maize fields in the coastal plain of Georgia during the four seasons 1930–33. Larvae collected early in May 1931 were bred in the laboratory through three complete generations and a partial fourth, the greatest number entering hibernation during the latter half of September. Within a few weeks of being placed in soil hibernation cages in September for observation, every one of a number of larvae hibernating in maize stalks was found to have been devoured by the predacious ant, *Solenopsis geminata xyloni*, McCook. Many subsequent observations on this ant, especially in maize fields on the coastal plain, indicated that it was probably the most important factor limiting the abundance of the borer.

BARBER (G. W.). **Insects attacking *Solanum sisymbriifolium* in eastern Georgia.**—*J. econ. Ent.* **26** no. 6 pp. 1174–1175. Geneva, N.Y., December 1933.

Solanum sisymbriifolium, a weed introduced from tropical America into the southern United States, appears in eastern Georgia in March or April and grows luxuriantly until October. Throughout the intervening period it provides suitable food for *Leptinotarsa decemlineata*, Say, which migrates to it after the potato crop has been harvested in June, *Heliothis virescens*, F. (tobacco budworm), the larvae of which attack the tender leaves and unripe fruit over a period of 5–6 months during which as many generations may develop on it, whereas tobacco is also harvested during June, and *Protoparce sexta*, Joh. (tomato worm), which is often as abundant on it from April to mid-August as on tomato.

DANIELS (L. B.). **A Flotation Method for determining Abundance of Potato Flea Beetle Larvae.**—*J. econ. Ent.* **26** no. 6 pp. 1175–1177, 1 fig., 2 refs. Geneva, N.Y., December 1933.

A method that proved very satisfactory in 1931 and 1932 in north-eastern Colorado for determining the relative abundance of larvae and pupae of *Epitrix cucumeris*, Harr., in potato hills is described. The larvae and pupae, which are too delicate to withstand the ordinary methods of sifting [*R.A.E.*, A **17** 183] or washing [**19** 213], were floated to the surface by agitating the soil in shallow galvanised pans with water, which was subsequently poured through brass screens of increasing fineness. The soil was allowed several minutes to settle, so as to eliminate clogging of the screens with mud when the liquid was poured off the sample. The screen of $\frac{1}{10}$-inch mesh removed all sticks and rubbish; the pupae and some larvae were caught in the $\frac{1}{20}$-inch, but most of the larvae were taken in the $\frac{1}{40}$-inch screen. The screens were mounted on frames set in a wooden rack, the construction of which is described.

Cressman (A. W.) & Kessels (L. T.). **Winter Mortality of the Camphor Scale and Dictyosperma Scale in 1933 at New Orleans, La.**—*J. econ. Ent.* **26** no. 6 pp. 1177–1179, 1 ref. Geneva, N.Y., December 1933.

Severe frost in 1924 at New Orleans [*R.A.E.*, A **12** 586] resulted in the almost complete control of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), which survived only in a few greenhouses and ceased from that time to be a pest of any importance. Records are here given of the mortality under similar conditions in 1933 of *C. dictyospermi*, Morg., and *Pseudaonidia duplex*, Ckll., which were less completely controlled in 1924 and have since become steadily more numerous. Preliminary records of *P. duplex* were made as soon as the severe frost threatened, and subsequent observations showed that 30–37 per cent. of the overwintering scales on wood uninjured by frost were killed by the low temperatures (20–17·5°F.) occurring on 9th February 1933. The actual mortality on camphor [*Cinnamomum camphora*] was considerably higher, as many of the younger twigs were killed. As active larvae tend to migrate to younger growth, a large proportion of the living scales were on wood that was frozen. Observations of *C. dictyospermi* on *Podocarpus* leaves, made after the frost only, indicated a mortality of 96·4 per cent., but on 30th March a number of living adults were reproducing and eggs and larvae were found beneath the coverings. Normal mortality in 1927 ranged between 30 and 40 per cent. during the winter. Although enough scales have been killed in 1933 to reduce the infestation considerably, it is improbable that *C. dictyospermi* has been eradicated.

Worthley (H. N.). **Spraying for Codling Moth Control.**—*Bull. Pennsylvania agric. Exp. Sta.* no. 285, 16 pp., 3 figs., 10 refs. State College, Pa, March 1933. [Recd. December 1933.]

Spraying experiments carried out during the two seasons 1931–32, in view of the difficulty experienced in the control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in southern Pennsylvania [*cf. R.A.E.*, A **21** 81], indicated that heavy infestation is best reduced by a petal-fall and 3 or 4 carefully timed cover sprays of 3 lb. lead arsenate to 100 U.S. gals. water applied against the first brood up to mid-July, with the addition of 1 U.S. qt. fish oil to 1 or 2 of the sprays in June. Lead arsenate at lower rates was valueless, even when used with a casein spreader; the addition of hydrated lime decreased its effectiveness, and the results of incorporating miscible oil were not satisfactory. Nicotine tannate did not prove a promising substitute for lead arsenate. The application of lead arsenate on 30th July produced excessive residue even at reduced dosages, and the correct time for treatment of the second brood was not until mid-August. In 1932, four cover sprays, and a fifth applied at a reduced rate in late July, resulted in about 50 per cent. less larvae hibernating than on the same trees in 1931. The petal-fall treatment was as valuable as any of the cover sprays, which were all of importance in the control, except possibly the first.

The period of 3–4 years before this programme of spraying against the first brood only will give a high percentage of sound fruit may be reduced by thoroughly scraping the trees and using chemically treated bands [**21** 69].

Box (H. E.). **Further Observations on Sugar-cane Moth Borers (*Diatraea* spp.) in St. Lucia. Introduction of the Cuban Parasite, *Lixophaga diatraeae*, Townsend. Report upon a Visit to St. Lucia, August-September, 1933. With an Appendix on the recommended Biological Control of the White Coffee-leaf Miner (*Leucoptera coffeella*, Guér.) in St. Lucia.**—Fol. 10 pp., 7 refs. Castries, 1933.

The author visited St. Lucia from Antigua from 19th August to 13th September for the purpose of introducing *Lixophaga diatraeae*, Towns., into fields of sugar-cane and making further investigations on *Diatraea* spp. and their food-plants [*cf. R.A.E.*, A **21** 410]. *D. saccharalis*, F., was more abundant than *D. canella*, Hmps., which attacks sugar-cane but not maize; *D. lineolata*, Wlk., which infests only maize, was not observed and is probably rare and local. Further additions are made to the list of grasses attacked by the other two species. *Cordyceps barberi* was considerably less abundant than in Antigua or St. Kitts [**20** 583, 708], attacking a maximum of about 5 per cent. of the larvae in sugar-cane. It is not expected that current parasitism by this fungus or by *Microdus stigmaterus*, Cress., will seriously affect the progress of *Lixophaga*.

The rearing of the Tachinid was carried out in essentially the same manner as previously described [**21** 662]. The original consignments from Antigua consisted of fertilised females to be dissected within 6 days and about 500 puparia due to mature within 2 weeks, from which some fertilised females were retained for dissection and others were liberated. At least two colonies were placed in suitable fields in four properties. Before the end of the visit, flies of the generation bred in St. Lucia were being distributed. Proof of the establishment of the parasite was first obtained on 18th September and again on 6th October from fields colonised on 27th August and 4th and 16th September. In experiments, larvae of *Lixophaga* rarely developed beyond the first or second instar in *D. canella*, probably owing to the structure of the tracheal system, and gravid females appeared to ignore borers of this species. Investigations in St. Kitts indicated that the distribution of the Tachinid is not influenced by rainfall, and it is therefore likely to be as effective in the dry windward districts in St. Lucia as in the wet valleys to leeward [*cf.* **21** 410].

The re-establishment of the coffee industry in St. Lucia is entirely prevented by the activities of *Leucoptera coffeella*, Guér. (white coffee leaf-miner). In an appendix, information is given from a previous paper on this pest in Kenya Colony [**11** 549]. The introduction of the Eulophids, *Chrysocharis livida*, Ashm., and *Zagrammosoma multilineatum*, Ashm., which occur in Porto Rico [**10** 535] and probably in Venezuela [**15** 324], into the potential coffee-growing areas is suggested.

Strong (L. A.). **Report of the Chief of the Bureau of Plant Quarantine, 1933.**—66 pp. Washington, D.C., U.S. Dep. Agric., 1933.

The activities of the Plant Quarantine and Control Administration for the year ending 30th June 1933 are reviewed, the insect pests dealt with being *Porthetria dispar*, L., *Nygmia phaeorrhoea*, Don., *Stilpnotia salicis*, L., *Pyrausta nubilalis*, Hb., *Popillia japonica*, Newm., *Platyedra* (*Pectinophora*) *gossypiella*, Saund., *Anthonomus grandis thurberiae*, Pierce, *Anastrepha ludens*, Lw., *Parlatoria blanchardi*, Targ., and the narcissus bulb flies, *Merodon equestris*, F., and *Eumerus* spp.

In traps for *A. ludens* in *Citrus* groves in Texas, the following additional species of fruit-flies were recovered during the year : *A. pallens*, Coq., which normally infests *Brumelia angustifolia* and is not known to attack commercial fruit, *A. fraterculus*, Wied., and *A. serpentina*, Wied., the last-named apparently for the first time in the United States. An adult of *Toxotrypana curvicauda*, Gerst. (papaya fruit-fly) was also taken in the Rio Grande Valley, this being only the second record of its occurrence there. In order that there might be a period when *A. ludens* would be unable to find food, all October-bloom fruit was removed when still green from the trees, and a number of alternative food-plants, including guava, peach, plum, pear and apple trees, chiefly seedlings, were destroyed. The bearing trees of the quarantined area received two applications in 1932 of a bait spray of 1 gal. 40 per cent. nicotine sulphate and 20 gals. molasses in 179 gals. water, one in July and the other in late August ; a third application in groves that had been infested in spring and adjoining ones was completed in January 1933. Spraying was resumed towards the end of March, the first application being completed about the end of April, and the second begun on 22nd May and completed on 21st June.

HOGGAN (I. A.). **Some Factors involved in Aphid Transmission of the Cucumber-mosaic Virus to Tobacco.**—*J. agric. Res.* **47** no. 9 pp. 689–704, 1 fig., 23 refs. Washington, D.C., 1st November 1933.

In further studies in Wisconsin with a strain of cucumber mosaic virus in tobacco (to which it had been transmitted from cucumber by artificial inoculation) and *Myzus persicae*, Sulz. [*cf. R.A.E.*, A **17** 282], the percentage of healthy tobacco plants infected by the feeding of 5 Aphids was 25 and by 20 Aphids 80. Tobacco was occasionally (and cucumber rather more frequently) infected by 1 or 2 Aphids.

The following results were obtained in experiments on the transmission of the virus from infected to healthy tobacco plants by *M. persicae*. All forms and stages appeared to be equally effective vectors, but adults that had become infected as nymphs were not infective. Aphids that had fed 15 minutes on an infected plant and 15 minutes on a healthy one transmitted the disease to the latter, no incubation period being involved. Infective Aphids lost their infectivity after feeding for 2 hours on a healthy plant or after starvation for 18–27 hours, but not for 2–3 hours. The percentage of infection obtained was much lower (35 : 80) when the Aphids were transferred by means of a camel's-hair brush than when they were moved on diseased leaves and allowed to migrate to the new food-plant. No evidence was obtained of any direct transmission of the virus by infective adults to their offspring [*cf.* **21** 536].

The results obtained are believed to indicate that the transmission of this virus by *M. persicae* is a purely mechanical process, explicable on the hypothesis that infectious material is transferred on contaminated mouth parts. The process appears to be very different from that occurring in the transmission of the potato leaf-roll virus by the same insect [**15** 509 ; **17** 496, 636 ; **19** 459] or of certain viruses by leafhoppers [**12** 79 ; **14** 164 ; **21** 486]. It is suggested that the selective action by which *M. persicae* transmits only the cucumber mosaic virus from tobacco plants infected with a combination of this and the true tobacco mosaic virus [**17** 282] may be due to inability of the Aphids to withdraw the latter from the infected plant.

Blanchard (R. A.), Walker (H. B.) & Hedden (O. K.). **Burning for the Control of Aphids on Alfalfa in the Antelope Valley of California.** —*Circ. U.S. Dep. Agric.* no. 287, 24 pp., 8 figs., 4 graphs. Washington, D.C., October 1933.

In fields of lucerne in southern California severely infested with *Acyrthosiphon onobrychis*, Boy. (*Illinoia pisi*, Kalt.), the first crop could only be saved by burning the fields between 12th March and 1st April. Three types of burners used with tractors in 1929–31 are described. In a single burning 30–40 U.S. gals. of oil, and in double burning 30 U.S. gals., were used per acre for each operation. The burning was more effective if the lucerne had been cut and allowed to dry on the fields. The new growth was more succulent than in unburned fields, the crop was usually taller and freer from weeds at the time of the first mowing and the yield was considerably greater. The burning should be carried out each spring and the fields irrigated as soon as the new growth begins. If the fields are burnt over too early, they are liable to reinfestation by winged migrants, which are attracted by the succulent new growth and favoured by the fact that many natural enemies have been destroyed. After the end of March, however, the climatic conditions prevent serious reinfestation.

Batchelder (C. H.) & Questel (D. D.). **Subfreezing Temperatures Lethal to the European Corn Borer infesting Green Ears of Sweet Corn.**—*Tech. Bull. U.S. Dep. Agric.* no. 395, 13 pp., 6 figs. Washington, D.C., October 1933. [Recd. December 1933.]

The following information is taken from the authors' summary of experiments to determine whether refrigeration is a safeguard against the spread of *Pyrausta nubilalis*, Hb., in green maize ears in the United States.

Larvae exposed without the protection of the maize cob were killed at −25°F. in 10 minutes, at −20°F. in 12½ minutes, at −10°F. in 20 minutes, at 0°F. in 150 minutes and at 15°F. in 65 hours. Eggs and pupae attached to foliage were destroyed by exposure to approximately 0°F. for 48 hours. When uninfested ears of green sweet maize were exposed to −22°F. in a plate refrigerator, the temperature in the pith of the cobs was reduced to 0°F. in 3–4 hours, according to the variety, and when they were exposed to 0°F. in a ventilated cold room, in 15 hours. Larvae in tunnels in the pith were killed after 4 hours in a plate refrigerator at −22°F., after 18 hours in a cold room at −20°F., and after 65 hours in a cold room at 0°F. Only 15·6 per cent. were killed in cobs packed in bushel boxes and exposed to a cold-room temperature of 30°F. for 6 days. In ventilated boxes, all the larvae were killed when the temperature in the spaces at the centre of the box was maintained at 0°F. for 8 days ; in unventilated boxes, owing to the heat generated by the metabolism of the ears, the temperature at the centre tended to become stabilised about 27°F.

Wilcoxon (F.), Hartzell (A.) & Youden (W. J.). **Greenhouse Fumigations with Naphthalene Solutions.**—*Contr. Boyce Thompson Inst.* **5** no. 4 pp. 461–469, 3 figs., 5 refs. Yonkers, N.Y., 1933.

A method of greenhouse fumigation with naphthalene previously noticed [*R.A.E.*, A **18** 578] proved unsatisfactory in cold weather, owing to the necessity of drawing air from a source outside. If, on the other hand, air is continuously recirculated through the saturator, a

vapour concentration may be reached that is injurious to plants [*cf.* **17** 449]. In the apparatus here described, the air circulates through a saturator containing a solution of naphthalene in an inert solvent, so that the concentration of the naphthalene in the solvent determines the maximum concentration of vapour that can be reached. When a solid solvent (sulphur) is used, the container already described is suitable. When an oil solution is used, it is contained in a large cylinder, open at the top and with a smaller open cylinder inserted into it through the bottom. The liquid is pumped from the bottom of the large cylinder through a pipe passing up its side, and back into it above the top of the small cylinder. The air is drawn by an electric fan up through the small cylinder and deflected downwards by a cone surmounting it so that it passes through a rain of the liquid pouring from the pipe over the cone. It then escapes through the top of the large cylinder, after passing through four cheese-cloth traps to remove any droplets of liquid. Satisfactory control of *Tetranychus telarius*, L., was obtained with either of these methods, by fumigating for 14–16 hours, without injury to plants usually considered sensitive to naphthalene.

ALDRICH (J. M.). **Notes on Diptera. No. 6.**—*Proc. ent. Soc. Wash.* **35** no. 8 pp. 165–170. Washington, D.C., November 1933.

The author discusses the synonymy of the Tachinid, *Parasetigena silvestris*, R.-D. (*segregata*, auct.), and regards *Parasetigena* as a subgenus of *Phorocera*.

ALDRICH (J. M.). **Two reared Species of Tachinidae from South America.**—*Proc. ent. Soc. Wash.* **35** no. 8 pp. 170–173, 1 fig. Washington, D.C., November 1933.

Both sexes of the Tachinid, *Metagonistylum minense*, Towns., are redescribed from specimens reared from *Diatraea saccharalis*, F., in Brazil.

POOS (F. W.). **Four new Species of** *Empoasca* **(Homoptera : Cicadellidae).**—*Proc. ent. Soc. Wash.* **35** no. 8 pp. 174–179, 6 figs., 5 refs. Washington, D.C., November 1933.

Descriptions are given of the male of *Empoasca sativae*, sp. n., found on lucerne in Kansas, Louisiana, Tennessee and Virginia, and of both sexes of *E. batatae*, sp. n., found on sweet potato in Florida and on leguminous plants in Minas Geraes, Brazil.

BLAKE (D. H.). **Two new Species of** *Systena*, **with Notes on Differences in Sexual Coloration in the Genus.**—*Proc. ent. Soc. Wash.* **35** no. 8 pp. 180–183, 1 pl., 5 refs. Washington, D.C., November 1933.

Both sexes are described of the Halticid, *Systena dimorpha*, sp. n., on okra [*Hibiscus esculentus*], beet and *Xanthium* sp. in the western United States.

EMMART (E. W.). **The Eggs of Four Species of Fruit Flies of the Genus** *Anastrepha*.—*Proc. ent. Soc. Wash.* **35** no. 8 pp. 184–191, 2 pls., 5 refs. Washington, D.C., November 1933.

A description is given of the characters distinguishing the eggs of the four species of *Anastrepha* common in Mexico, *viz.*, *A. ludens*, Lw., *A.*

striata, Schin., *A. fraterculus*, Wied., and *A. serpentina*, Wied. Their preferred food-plants are respectively mango, guava, hog-plum (*Spondias*) and sapote mamey, *Lucuma* (*Calocarpum*) *mammosa*.

Minutes of the 449th Regular Meeting of the Entomological Society of Washington, Oct. 5, 1933.—*Proc. ent. Soc. Wash.* **35** no. 8 pp. 191–192. Washington, D.C., November 1933.

An abstract is given of a paper by A. Busck, in which he states that *Platynota chiquitana*, Barnes & Busck, recorded as a pest of *Citrus* [*cf. R.A.E.*, A **17** 718] and other plants in California, is a synonym of *P. stultana*, Wlsm. In 1933, this Tortricid was abundant on green pepper [*Capsicum*] and tomato in Mexico, and was found (for the first time in the eastern United States) in Virginia, on rose in a greenhouse. In California, it has been erroneously recorded [**8** 508; *cf.* **13** 48, 507] as *P. tinctana*, Wlk., which occurs in Texas.

Dennys (A. A.). **Materials used as Canker Paints in Woolly Aphis Control.**—*Proc. ent. Soc. Brit. Columbia* no. 30 pp. 8–10. Victoria, B.C., March 1933. [Recd. December 1933.]

Of 100 materials and mixtures tested in British Columbia in 1929–32 for painting cankers and pruning wounds on apple to prevent infestation by *Eriosoma lanigerum*, Hsm. [*cf. R.A.E.*, A **19** 104, etc.], the best was a mixture of 25 per cent. of a special machine oil and 2½ per cent. nicotine sulphate emulsified in water with 5 per cent. wheat flour (boiled into a paste). This emulsion stood for 15 hours without separating. The oil was a proprietary one made of a solution of 2½ per cent. aluminium napthenate in a brown neutral mineral oil. The mixture was cheaper than others found effective, and cankers treated with it in July remained free from Aphid infestation for a year.

Tests using the constituents separately showed that the nicotine sulphate produced the toxic effect. The author suggests that it forms an oil-soluble aluminium-nicotine-napthenate compound with the oil so that the duration of its toxicity is prolonged.

Venables (E. P.). **Notes on the Tarnished Plant Bug in the Dry Belt of British Columbia.**—*Proc. ent. Soc. Brit. Columbia* no. 30 pp. 17–20. Victoria, B.C., March 1933. [Recd. December 1933.]

Damage to fruit trees by *Lygus pratensis*, L. (tarnished plant bug) in the north-western United States [*cf. R.A.E.*, A **20** 20, 25] and British Columbia has recently been increasing.

Observations in irrigated orchards in British Columbia in 1927–32 showed that apple buds pierced by the bugs in spring generally died in a short time, whereas pear buds, being larger, frequently produced a few leaves and blossoms, unless injury had been very severe. The fruit is infested early in the season, and its development is checked, a conical depression being formed at the point attacked. Collections of bugs made in late summer and autumn of 1931, in areas where lucerne, sweet clover [*Melilotus*] and vetch were grown as cover crops, showed that lucerne was the most favourable for hibernation. Sweeps with a net in spring showed that the bugs become evenly distributed over wide areas during April–May. They injured over 90 per cent. of the buds in one orchard that was sheltered from the prevailing winds, whereas in an unsheltered one only 100 yards away they were very scarce. Neither the method of

cultivation nor the absence of hibernation sites had much effect on the numbers present on lucerne in orchards in spring. Eggs were laid during April singly or in small batches in the stems of lucerne, usually at the base of the current season's growth, when the plants were about 4–6 inches high. They were found only in rough parts of the stem near the ground, especially where they were abraded or cracked, and were commonest in isolated plants with well developed crowns. A few were found in buds or young fruits of apple.

The percentages of injured buds on 15th April on trees sprayed on 21st–23rd March with lime-sulphur (1 : 20), alone or with 3 per cent. oil, were 18 and 10 respectively, as against 34–71 on unsprayed trees. Higher concentrations (1 : 9) caused some injury to the buds. A nicotine dust proved of no value against the adults.

Spencer (G. J.). **The Identity of the Carnation Maggots of British Columbia.**—*Proc. ent. Soc. Brit. Columbia* no. 30 pp. 21–22. Victoria, B.C., March 1933. [Recd. December 1933.]

Injury caused to greenhouse carnations by Anthomyiid larvae in British Columbia in 1930 was of two kinds : either the stems were eaten away underground and slightly above ground, both from the side and up the centre, or the larvae worked gregariously at the tips of the plants, eating away the bases of the leaves and growing points and burrowing down the stem for short distances, so that the plants withered from the tips downwards. The species involved were identified as *Hylemyia brunnescens*, Zett. [*cf. R.A.E.*, A **17** 318], *Helina duplicata* Mg. [probably a predacious species], *Phorbia* (*Hylemyia*) *florilega*, Zett., and *Coenosia* (*Caricea*) *humilis*, Mg. The latter is believed to be common in greenhouses and not specifically associated with carnations. *P. florilega* was more abundant than *H. duplicata* and probably caused most of the injury.

Jones (H. A.). **Notes on the Occurrence of Rotenone in Species of *Derris* and *Lonchocarpus*.**—*J. Wash. Acad. Sci.* **23** no. 11 pp. 493–496, 11 refs. Menasha, Wis., 15th November 1933.

No trace of rotenone was found in samples of stems and leaves of *Derris elliptica* from Fiji, or in leaves of *D. uliginosa* from the same Islands, but about 0·1 per cent. rotenone was obtained from the stems of the latter by carbon tetrachloride extraction. The percentages of rotenone and (in brackets) total extractives obtained from samples of cubé (*Lonchocarpus nicou*) [*cf. R.A.E.*, A **21** 99, 618] from Peru were : fine roots, 6·9–8·3 (17–19·8) ; coarse roots, 2 (7·2) ; bark of coarse roots, 4·7 (16·4) ; inner part of the same, 1·2 (5) ; stems, 0·3 (3·2) ; leaves, 0 (0). Other percentages obtained were : roots of *L. velutinus* from an unknown source, 0 (0), and from Peru, 1·9 (12·2) ; stem of " haiari " (*Lonchocarpus* sp.), 1 (4·8) ; roots of (?) *Lonchocarpus* sp. from Paraguay, 8·9 (22·6) ; " cipo " (*Lonchocarpus* sp.) roots from Brazil, 1·2 (9·1) ; Brazilian " timbo " root, 16·3 (38·7). The term " timbo " is applied both to *L. urucu* and to *Paullinia pinnata*, and the identity of the sample tested is doubtful.

Janvier (H.). **Etude biologique de quelques Hyménoptères du Chili.**—*Ann. Sci. nat. Zool.* (10) **16** no. 2 pp. 209–356, 63 figs. Paris, October 1933.

The greater part of this article deals with predacious and parasitic Hymenoptera in Chile, with descriptions and biological notes. The

most important economically are various species of Thynnids, especially *Elaphroptera* spp. The females are wingless and largely subterranean, though they are generally carried on a long flight by the males in the morning. They lay their eggs on Lamellicorn larvae, which they first paralyse, and also kill large numbers of the latter for food, penetrating to a depth of $1\frac{1}{4}$ ft. in the soil. Larvae of *Elaphroptera* have been sent to New Zealand for the control of Lamellicorn pests, and the author suggests that their introduction into Europe would help to reduce losses due to *Melolontha melolontha*, L. (*vulgaris*, F.).

Antholcus varinervis, Spin., is extremely useful in the destruction of *Acaena* spp., the fruits of which by catching in the wool of sheep cause an annual loss in its value estimated at 2 million pounds sterling. This sawfly has been introduced into New Zealand [*R.A.E.*, A **20** 271] with excellent results. It oviposits by preference in leaves of *Acaena argentea*, but the larvae feed equally readily on the leaves, buds and flowers of other species. The eggs, which are laid in late May, hatch in July, and the larvae continue feeding generally till December, when they burrow 2–4 inches into the soil. Those that hatch and complete their growth earliest pupate in the following April, while the pupation of the others is deferred for another year. The adults emerge early in May.

BALLARD (E.). **Trapping the Mediterranean Fruit Fly, *Ceratitis capitata* (Wied.).**—*Bull. Soc. roy. ent. Egypte* 1933 fasc. 1–3 pp. 8–13, 1 fig., 9 refs. Cairo, 1933.

In trapping experiments in Egypt against *Ceratitis capitata*, Wied., stoppered glass bottles filled to about half the height of the open conical base [*cf. R.A.E.*, A **18** 179] were hung in an orange grove, one in every other tree. The average number of flies caught per week per bottle from 26th September 1931 to 9th January 1932 with baits of 10 per cent. sugar-cane molasses and 20 or 30 per cent. refined vinegar were respectively 11·96, 2·12 and 2·21. The damage caused on 40 trees left untreated was as slight as on the treated ones, indicating that all the flies were caught in the traps. A large majority were females, most of which had not oviposited. Other insects caught included 29 *Dacus oleae*, Gmel. (olive fruit-fly), 1,172 *Lonchaea* spp., mostly *L. aristella*, Beck., a pest of figs, and 7,761 *Atherigona* spp., which are pests of grasses and cereals in India [**12** 386], but also numerous beneficial insects, especially Tachinids (6,050) and *Chrysopa* spp. (131).

ZACHER (F.). **La biocénose des greniers, moulins et dépôts, ses rapports avec son habitat extérieur, et ses modifications à la suite de l'évolution du commerce mondial.**—*Bull. Soc. roy. ent. Egypte* 1933 fasc. 1–3 pp. 68–75. Cairo, 1933.

This a general account of the pests attacking stored products in granaries, mills and warehouses, the species concerned in Germany numbering about 400. A systematic list is given of the families represented, with a further list of species that breed and feed exclusively in storehouses in Germany. Examples are given of the types of insects that feed on cereals, flour and waste from cereals, fungi, dried vegetable and chemical products, dried animal substances, and timber and furniture, with instances of their parasites and predators.

The author distinguishes between species that are exclusively adapted to storehouse conditions, those that are able to live equally well elsewhere, and those that merely occur accidentally under such conditions,

and shows that a species may gradually pass from the last group to the second and first. Most of the European pests of stored products are imported, and the time and conditions of introduction of a number of well-known examples are cited. Of species transported to new habitats by commercial movements, only a few have succeeded in acclimatising themselves. Instances are given of partial adaptation where special conditions happen to be fulfilled. The possibility of the introduction of additional insect pests of stored products is discussed, and the necessity for preventive measures, such as fumigation of imported and exported cereals, is emphasised.

PAPERS NOTICED BY TITLE ONLY.

METCALFE (M. E.). **Notes on the Structure and Development of the Female Genital System in *Dasyneura leguminicola* Lint. (Cecidomyidae-Diptera).**—*Quart. J. micr. Sci.* N.S. **76** pt. 1 pp. 89–105, 2 pls., 4 figs., 29 refs. London, June 1933. [Recd. December 1933.]

SAALAS (U.). **Tuhohyönteisten joukkoesiintymisestä ja sen syistä.** [Outbreaks of Insect Pests and their Causes.] [*In Finnish.*]—*Sampsan juhlajulk.* 1932, reprint 10 pp. [Recd. December 1933.]

BÖRNER (C.). **Kleine Mitteilungen über Blattläuse.** [Brief Notes on Aphids (including new genera and species).]—4 pp. Naumburg, Saale, the author, 24th May 1933. [Recd. January 1934.]

TÓTH (L.). **Ueber die frühembryonale Entwicklung der viviparen Aphiden.** [On the early Embryonic Development of Viviparous Aphids.]—*Z. Morph. Oekol. Tiere* **27** no. 4 pp. 692–731, 45 figs., 21 refs. Berlin, 23rd November 1933.

HERING (M.). **Die Blattminen an Apfel- und Birnbaum.** [The Leaf-mines caused by Insects on Apple and Pear.]—*Anz. Schädlingsk.* **9** no. 12 pp. 149–159, 16 figs. Berlin, December 1933.

HERING (M.). **Synopsis der Ahorn-Minen.** [A Synopsis of Maple Leaf-mines.]—*Ent. Jb.* **43** pp. 66–74, 7 figs. Leipzig, 1934.

LINDINGER (L.). **Die Schildlaus-Arten P. Fr. Bouchés und ihre Deutung.** [The Coccid Species of Bouché and their Interpretation, with a list of Bouché's names and their present-day equivalents.]—*Ent. Jb.* **43** pp. 153–169. Leipzig, 1934.

GOUX (L.). **Notes sur les coccides de la France (6e note). Nouvelles observations sur les Pseudococcines.**—*Bull. Soc. ent. Fr.* **38** no. 15 pp. 234–236. Paris, 1933.

BALACHOWSKY (A.). **Contribution à l'étude des coccides du Nord-Africain (12me note). Diaspines récoltées dans la région de Tamanrasset (Massif du Hoggar) par J. Lauriol.**—*Bull. Soc. Hist. nat. Afr. N.* **24** no. 8 pp. 253–254, 1 ref. Algiers, November 1933.

BALACHOWSKY (A.). **Contribution à l'étude des coccides de l'Afrique mineure. (13e note). Sur une nouvelle Diaspine** [*Aspidiotus tubuliferus* sp. n.] **récoltée par le Dr. R. Maire dans le Moyen-Atlas** [Morocco]—*Bull. Soc. ent. Fr.* **38** no. 15 pp. 245–248, 1 fig. Paris, 1933.

COLIZZA (C.). **Contributo alla conoscenza delle cocciniglie del Mozambico (Hemip. Coccidae).** [A Contribution to the Knowledge of the Coccids of Mozambique. *Pseudococcus africanus*, sp. n.]—*Boll. Soc. ent. ital.* **65** no. 8 pp. 174–178, 2 figs., 2 refs. Genoa, 26th October 1933.

FROGGATT (W. W.). **The Coccidae of the Casuarinas** [in Australia, including 1 new genus and 5 new species].—*Proc. Linn. Soc. N.S.W.* **58** pt. 5–6 pp. 363–374, 1 pl., 36 figs. Sydney, 15th December 1933.

SMITH (J. H.). **The Tobacco Beetle** [*Lasioderma serricorne*, F.].—*Qd agric. J.* **40** pt. 4 pp. 288–290, 1 pl.; also as *Adv. Leafl. Dep. Agric. Stk Qd* no. 5, 3 pp., 1 pl. Brisbane, 1st October 1933. [See *R.A.E.*, A **22** 23.]

WATANABE (C.). **On some Species of *Apanteles* in Japan.** [*In Japanese.*]—*Insect World* **37** nos. 5–6 pp. 147–151, 190–196. Gifu, May–June 1933. [*Cf. R.A.E.*, A **21** 211.]

TAKAHASHI (R.). *Pemphigella aedificator* **Buckton produces Galls in Formosa** [on *Pistacia chinensis*] **(Aphididae Hemiptera).**—*Trans. nat. Hist. Soc. Formosa* **23** no. 128–129 pp. 352–353. 1 fig. Taihoku, December 1933.

FELT (E. P.). **A Hibiscus Bud Midge new to Hawaii** [*Contarinia maculipennis*, sp. n.].—*Proc. Hawaii. ent. Soc.* **8** no. 2 pp. 247–248. Honolulu, November 1933.

BRITTAIN (W. H.) & NEWTON (D. E.). **A Study in the Relative Constancy of Hive Bees and Wild Bees in Pollen Gathering.**—*Canad. J. Res.* **9** no. 4 pp. 334–349, 23 refs. Ottawa, October 1933.

ATWOOD (C. E.). **Studies on the Apoidea of western Nova Scotia with special Reference to Visitors to Apple Bloom.**—*Canad. J. Res.* **9** no. 5 pp. 443–457, 8 refs. Ottawa, November 1933.

MILLER (F. W.). **Three new Species of Aphids from Idaho.**—*Canad. Ent.* **65** no. 11 pp. 249–253, 1 pl. Orillia, November 1933.

SEAMANS (F. M.). **Protozoan Parasites of the Orthoptera, with special Reference to those of central and southeastern Ohio.** (Abstract.)—*J. Parasit.* **20** no. 2 pp. 125–126. Lancaster, Pa, December 1933.

COLLINS (C. W.). **The Oriental Moth** (*Cnidocampa* [*Monema*] *flavescens* **Walk.) and its Control.**—*Circ. U.S. Dep. Agric.* no. 277, 8 pp., 8 figs. Washington, D.C., June 1933. [Recd. December 1933.] [*Cf. R.A.E.*, A **21** 232.]

DAMPF (A.). **Estudio sobre el oviscapto de las moscas de la fruta** (*Anastrepha* **spp.) de Mexico.** [Morphological Studies on the Ovipositor of the Fruit-flies (*Anastrepha* spp.) of Mexico.]—*Irrig. en Mex.* **6** no. 3 pp. 253–265, 16 figs. Mexico, September 1933.

RONNA (E.). **Catalogo dos insétos até hoje encontrados nas plantas do Rio Grande do Sul.** [Catalogue of Insects hitherto found on Plants in the State of Rio Grande do Sul, Brazil.]—*Egatea* **18** pp. 47–53, 96–100, 197–202, 275–278, 329–334. Porto Alegre, 1933.

MOULTON (D.). **The Thysanoptera of South America (Conclusion).**—*Rev. Ent.* **3** fasc. 4 pp. 447–458, 7 pp. refs. Rio de Janeiro, 13th December 1933. [*Cf. R.A.E.*, A **21** 688.]

IMPERIAL INSTITUTE OF ENTOMOLOGY.

LIBRARY LACUNAE.

The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.

ANNALS OF THE QUEENSLAND MUSEUM (BRISBANE). Nos. 1, 5 and 6 (1891–).
ANNUAIRE ET MÉMOIRES DU COMITÉ D'ÉTUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (GORÉE) : Vols. I-II (1916–17).
AGRICULTURAL JOURNAL, DEPARTMENT OF AGRICULTURE, BRITISH COLUMBIA (VICTORIA) : Vol. I (1916). Nos. 1 and 2.
AGRICULTURAL NEWS (BARBADOS) : Nos. 1, 25, 26, 34, 66 (1902–04).
ARCHIVES DE L'INSTITUT PASTEUR DE TUNIS :
1906–09 ; 1910, fasc. i–iii ; 1911, fasc. iii–iv.
ARCHIV FÜR SCHIFFS- UND TROPEN-HYGIENE (LEIPZIG) :
Bd. XVII (1913). Hefte, 9, 13 & 14.
ARQUIVOS DO INSTITUTO BACTERIOLOGICO CAMARA PESTANA (LISBON) :
Vols. I–II (1906–10). Vol. III (1911–12) No. 1.
THE BEE WORLD (BENSON, OXON) : Vols. I–II (1919–21).
BIOLOGICAL BULLETIN OF THE MARINE BIOLOGICAL LABORATORY (WOODS HOLE, MASS.) :
Vols. I–II (1899-1901) ; XXIII (1912) ; XXIV (1912) No. 2 ; XXV (1913) Nos. 5–6 ; XXVI (1914) Nos. 1–2 ; XXVII (1914) No. 4 : XXVIII (1915) No. 1 ; XXIX (1915) No. 5 ; XXX (1916) Nos. 2–3 ; XXXI (1916) Nos. 4 & 6 ; XXXII–XXXIII (1917) ; XXXIV (1918) Nos. 1–4, & 6 ; XXXV (1918) ; XXXVI (1919) Nos. 2–3 ; XXXVII (1919) Nos. 4 & 6 ; XXXVIII (1920) Nos. 1, 2, 5 & 6 ; XXXIX (1920) Nos. 4–6 ; XL (1921) Nos. 1–4, & 6 ; XLI (1921) Nos. 2 & 3 ; XLII (1922) Nos. 1–3.
BOLETIN DE LA DIRECCION DE ESTUDIOS BIOLOGICAS (MEXICO) :
TOMOS I–II (1924–25).
BULLETIN DU COMITÉ D'ÉTUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (PARIS) : Année 1919, No. 1.
BULLETIN AGRICOLE DE L'ALGÉRIE—TUNISIE—MAROC (ALGIERS).
Année XX (1914). Nos. 7–9, 12–14 and Title-page.
CALIFORNIA AGRICULTURAL EXPERIMENT STATION (BERKELEY, CAL.):
Circulars 14 and 42 (1905–09).
CANADA : DEPARTMENT OF AGRICULTURE : EXPERIMENTAL FARMS :
Fletcher (J.). Reports of the Entomologist and Botanist for the Years 1886 and 1888. (Ottawa, 1887–89).
CHACARAS E QUINTAES (SÃO PAULO) : Indices to Vols. X, XI, XII and XIV.
COMPTES RENDUS DES SÉANCES DE L'ACADÉMIE D'AGRICULTURE DE FRANCE (PARIS) : Tome VIII (1922) No. 5.
EGATEA, REVISTA DA ESCOLA DE ENGENHARIA DE PORTO ALEGRE, BRAZIL :
Vols. I–VI (1916–21) ; VII (1922) Nos. 1–5 ; VIII (1923) Nos. 2–5 ; IX (1924) Nos. 1, 4–6.
ENTOMOLOGICA AMERICANA (BROOKLYN, N.Y.) :
Vol. IV (1888) Title-page. Vol. V (1889), Nos. 6 & 8.
ENTOMOLOGISCHE LITTERATURBLÄTTER (BERLIN) : 6 Jahrg. (1906). Nos. 2 & 10.
EXPERIMENT STATION RECORD (WASHINGTON, D.C.) : Vols. I–IV (1889–94).
GEORGIA STATE BOARD OF ENTOMOLOGY (ATLANTA) :
Bulletin : 2, 6, 22 and 28. Circular : 1 to 4, 12, 15 to 18 and 20.
GRASSI (B.) et al. Contributo alla conoscenza delle Filloserine ed in particolare della Fillossera della Vite. (Rome, 1912).
INDIA : FOREST RESEARCH INSTITUTE (DEHRA DUN).
Indian Forest Records : Vol. I, pts. i and iii.
Forest Bulletin (Old Series) : Nos. 1–3.
Forest Leaflet (Zoology Series) : Nos. 1–2.
INDIAN MEDICAL GAZETTE (CALCUTTA) :
Vol. L (1915) No. 10 ; LI (1916) Nos. 1–7, 10 ; LII (1917) No. 7 and title-page & index ; LIII (1918) ; and LIV (1919) No. 2.
INDIANA : Third Annual Report of the State Entomologist, 1909–10.
JOURNAL OF THE BOARD OF AGRICULTURE OF BRITISH GUIANA (DEMERARA) :
Vol. III (1909–10) No. 1. Title pp. and Indices to Vols. I–II.
JOURNAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE (WYE, KENT) :
Nos. 1–6, 8, 10–13, 17–21 (1895–1912).
KENTUCKY AGRICULTURAL EXPERIMENT STATION (LEXINGTON, KY.) :
Bulletin Nos. 21 (1889), 31 (1890), 47 (1893), 53 (1894), 71 (1898) and 91 (1901).

LIBRARY LACUNAE—*cont.*

THE KENYA AND EAST AFRICAN MEDICAL JOURNAL (NAIROBI); Vol. I. Nos. 3, 5, 7 (1924); II, Nos. 2–3 (1925).
NATUURHISTORISCH MAANDBLAD (MAASTRICHT): Jaarg. I (1912); II (1913) Nos. 1–4, 6–9; V (1916) Nos. 3–4; VII (1918) Nos. 6–9; VIII (1919) No. 4.
NEW JERSEY STATE DEPARTMENT OF AGRICULTURE (TRENTON, N. J.): Bulletin 2; Circular: 2, 12, 29 (1917–19).
NEW YORK STATE MUSEUM (ALBANY, N.Y.): Bulletin: 26 & 57 (1899–1902).
ONTARIO ENTOMOLOGICAL SOCIETY REPORT (TORONTO): 9th (1878).
ORMEROD (E. A.). OBSERVATIONS OF INJURIOUS INSECTS AND COMMON FARM PESTS DURING THE YEARS 1877 & 1878. (London, 1878–79).
PARASITOLOGY. Vol. VI, Nos. 1–3. Vol. IX, No. 1. (Cambridge, 1913–16).
PHILIPPINE AGRICULTURIST AND FORESTER (MANILA):
Vols. II, Nos. 1–3 (1912); III, Nos. 1, 2 (1914); IV, No. 4 (1915).

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Assistant Director.

The Annual Subscription, *in advance*, to the Review, Series A (Agricultural), is 18s. post free; Series B (Medical and Veterinary), 9s. post free. Subscriptions to the *current* Volume received after 30th June in each year will be charged at the published price *viz.*: Series A, 24s.; Series B, 12s. Prices of Back Volumes on application.

Orders and subscriptions should be sent direct to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS.

	PAGE
AFRICA, EAST: Pests of Vegetables in Italian Somaliland	77
AFRICA, EAST: A new Coccid in Mozambique (*Title only*)	112
AFRICA, FRENCH EQUATORIAL: *Helopeltis bergrothi* on Cotton	78
AFRICA, NORTH: Sarcophagid Parasites of Locusts in the Sudan	76
AFRICA, NORTH: *Pyrausta nubilalis* in Egypt	101
AFRICA, NORTH: Traps for *Ceratitis capitata* in Egypt	110
AFRICA, NORTH: Studies on Coccids (*Title only*)	111
AFRICA, SOUTH: Pests in Tobacco Seed-beds	49
AFRICA, SOUTH: Top-dressing Maize against *Busseola fusca*	79
AFRICA, SOUTH: Pests of *Citrus* in Southern Rhodesia	79
AFRICA, SOUTH: Experiments against *Scirtothrips aurantii*	80
AFRICA, SOUTH: Mass-rearing of *Microbracon brevicornis*	81
AMERICA, NORTH: Temperatures limiting northern Spread of *Leptinotarsa decemlineata*	93
AMERICA, SOUTH: Rotenone in Species of *Derris* and *Lonchocarpus* ...	109
AMERICA, SOUTH: A Revision of the Thysanoptera (*Title only*)	112
ARGENTINA: Methods of Locust Destruction	49
ARGENTINA: Keys to Pests of cultivated Plants	49
ARGENTINA: Oil Sprays against Orange Pests	49
ARGENTINA: Notes on *Galleria mellonella*	50
ASIA: Parasites of *Popillia japonica* in the Far East	72
AUSTRALIA: Measures against *Dacus ferrugineus* in Queensland	61
AUSTRALIA: Coccids attacking *Cyperus rotundus* in Queensland	62
AUSTRALIA: A Jassid and a Capsid on Tomato in Queensland	62
AUSTRALIA: A new Parasite of *Pseudococcus*	67
AUSTRALIA: Miscellaneous Pests in Queensland in 1932–33	81
AUSTRALIA: Notes on Coccinellids in N.S.W.	82
AUSTRALIA: Native Rhynchota attacking Fruit Trees, etc., in Victoria ...	82
AUSTRALIA: *Cryptophasa unipunctata* on Fruit Trees in Tasmania ...	83
AUSTRALIA: Regulations for Fruit-fly Control in N.S.W.	87

CONTENTS—*cont.*

PAGE

AUSTRALIA : Fumigation Experiments against *Aonidiella aurantii* in N.S.W. 88
AUSTRALIA : The Coccids occurring on *Casuarina* (*Title only*) 112
AUSTRALIA : *Lasioderma serricorne* in Queensland (*Title only*) 112
AUSTRALIA, SOUTH : Seasonal Fluctuations in Numbers of Blossom Thrips 60
AUSTRALIA, SOUTH : The Problem of *Smynthurus viridis* 61
BELGIUM : *Diaspis visci* and its Parasites 52
BELGIUM : Studies on *Pegomyia hyoscyami* in 1932 83
BRAZIL : A Tachinid Parasite of *Diatraea saccharalis* 107
BRAZIL : The Insects found on Plants in Rio Grande do Sul (*Title only*) ... 112
BRITISH ISLES : Effects of Fungicides on *Hoplocampa testudinea* ... 52
BRITISH ISLES : A Record of the Occurrence of *Diprion polytomum* ... 75
BRITISH ISLES : Cecidomyiids affecting Grass Seed Production 75
BRITISH ISLES : *Longitarsus* spp. on Ragwort 75
CANADA : Notes on parasitic Hymenoptera 67
CANADA : A Canker Paint against *Eriosoma lanigerum* in British Columbia 108
CANADA : *Lygus pratensis* on Apple, etc., in British Columbia 108
CANADA : Anthomyiids on Carnation in British Columbia 109
CANADA : Studies on Bees and Pollination (*Titles only*) 112
CHILE : Notes on Hymenoptera of Economic Importance 109
CHINA : Natural Enemies of *Pseudococcus comstocki* 67
CZECHOSLOVAKIA : Notes on *Lymantria monacha* 85
DENMARK : Miscellaneous Pests in 1932 86
FINLAND : Observations on *Diprion pini* 54
FORMOSA : The Occurrence of *Pemphigella aedificator* on *Pistacia* (*Title only*) 112
FRANCE : Aphids attacking Strawberry 51
FRANCE : Records of Coccids (*Titles only*) 111
GERMANY : A Key to Larvae found in Pine Forest Soil 53
GERMANY : *Ceuthorrhynchus quadridens* on Cabbage 84
GERMANY : Records of Forest Pests in 1933 85
GERMANY : The Control of *Lymantria monacha* 86
GERMANY : Date of Sowing Wheat in Relation to *Cephus pygmaeus* ... 86
GERMANY : The Method of Feeding of Aphids 86
HAWAII : The Introduction of a Malayan Parasite of *Oxya chinensis* ... 64
HAWAII : A new Cecidomyiid on *Hibiscus* (*Title only*) 112
ITALY : Insects attacking *Orobanche speciosa* 50
ITALY : An Insect-catching Plant 50
JAPAN : Transmission of a Virus Disease of Rice through the Eggs of the Insect Vector 59
JAPAN : Notes on Species of *Apanteles* (*Title only*) 112
KOREA : Studies on Insects infesting Italian Millet 57, 58
KOREA : The Bionomics and Control of *Phaedon incertus* 58
LATVIA : Observations on *Cheimatobia brumata* 53
LATVIA : Insects attacking Peas 53
MEXICO : The Eggs of *Anastrepha* spp. 107
MEXICO : The Morphology of the Ovipositor of *Anastrepha* spp. (*Title only*) 112
NETHERLANDS INDIES : A Coreid injurious to Pepper 59
NETHERLANDS INDIES : A Eumolpid attacking Tea in Sumatra 81
NEW HEBRIDES : An Earwig predacious on *Brontispa froggatti* 63
NEW ZEALAND : A Fungus associated with *Sirex noctilio* 87
PHILIPPINES : Arsenical Residues on Vegetables 50
RUSSIA : Tests of Dusts against *Panolis flammea* 55
RUSSIA : Standards of Fineness for Dust applied from Aeroplanes ... 55
RUSSIA : Soil Fumigation against *Polyphylla fullo* and *Melolontha hippocastani* 77
RUSSIA, ASIATIC : Aphids on Cotton in Azerbaijan 56
SANTA CRUZ ISLANDS : *Promecotheca* sp. on Coconut 63
SICILY : Injury to Hazel and Pistachio Nuts by Bugs 51
SICILY : A new Braconid Parasite of *Dacus oleae* 51
SOLOMON ISLANDS : Insects occurring on Coconut 64
U.S.A. : Coccinellids attacking *Paratrioza cockerelli* in Utah 66
U.S.A. : Insect Pests of Trees and Shrubs in Wisconsin 67
U.S.A. : Notes on Insect Pests in Utah 68
U.S.A. : The Bionomics and Control of *Murgantia histrionica* 69
U.S.A. : Miscellaneous Pests in S. Carolina in 1931–32 70
U.S.A. : Cranberry Varieties in Relation to *Euscelis striatulus* and False-blossum 71
U.S.A. : *Aonidiella aurantii* and its Control in Texas 72
U.S.A. : Lizards feeding on *Eutettix tenella* in Utah 88

CONTENTS—*cont.*

PAGE

U.S.A.: Strains of Insects resistant to Insecticides 88, 99
U.S.A.: Laboratory Experiments with Fumigants against *Pheletes californicus* 90
U.S.A.: The Application of Liquid Sprays from Aeroplanes 91
U.S.A.: Chemically treated Bands against *Cydia pomonella* 92
U.S.A.: The Bionomics of *Bruchus pisorum* 92, 93
U.S.A.: The possible Acclimatisation of *Paratenodera sinensis* 94
U.S.A.: The Status of *Lygus elisus* and *L. hesperus* 94
U.S.A.: Insects collected in Flight Traps in Idaho 94
U.S.A.: *Corythucha salicata* on Apple in Oregon 95
U.S.A.: Tests with Fluorine Compounds against *Anthonomus eugenii* ... 95
U.S.A.: *Rhagoletis pomonella* in Wisconsin 96
U.S.A.: Pine Oils against overwintering Codling Moth Larvae 96
U.S.A.: Lepidopterous Larvae infesting Golf Greens 97, 100
U.S.A.: A Factor affecting Injury to Cotton by *Anthonomus grandis* ... 97
U.S.A.: Studies of the larval Instars of *Dendroctonus pseudotsugae* ... 97
U.S.A.: Resistance of Clover Leaves to Puncturing 98
U.S.A.: Injury to Apples following Nicotine Tannate Sprays 98
U.S.A.: Resistance of *Aonidiella aurantii* to HCN 99
U.S.A.: A List of Popular Names of Insects 100
U.S.A.: *Pseudococcus adonidum* on *Citrus* in California 100
U.S.A.: Insects attacking Potato in Iowa 101
U.S.A.: An Ant destroying *Diatraea crambidoides* in Georgia 102
U.S.A.: Insect Pests feeding on *Solanum sisymbriifolium* 102
U.S.A.: A Method of obtaining Larvae of *Epitrix* from Soil 102
U.S.A.: Winter Mortality of Coccids in Louisiana 103
U.S.A.: Spraying against *Cydia pomonella* in Pennsylvania 103
U.S.A.: Report of the Bureau of Plant Quarantine, 1932–33 104
U.S.A.: Aphid Transmission of Cucumber Mosaic in Tobacco 105
U.S.A.: Burning for Control of Aphids on Lucerne in California 106
U.S.A.: Low Temperatures lethal to *Pyrausta nubilalis* in Maize Ears ... 106
U.S.A.: Greenhouse Fumigations with Naphthalene Solutions 106
U.S.A.: New Species of *Empoasca* 107
U.S.A.: A new Halticid on Beet, etc. 107
U.S.A.: A Note on *Platynota stultana* 108
U.S.A.: New Aphids from Idaho (*Title only*) 112
U.S.A.: Protozoan Parasites of Orthoptera (*Title only*) 112
U.S.A.: *Monema flavescens* and its Control (*Title only*) 112
URUGUAY: Notes on Fruit-Flies 65
WEST INDIES: An Economic Entomology (*Review*) 65
WEST INDIES: An early Reference to Sugar-cane Entomology 65
WEST INDIES: Miscellaneous Pests in Jamaica in 1932 66
WEST INDIES: Weevils ovipositing between Paper Strips 101
WEST INDIES: The Introduction of *Lixophaga diatraeae* into St. Lucia ... 104
Delayed Incubation of Eggs of *Oxya chinensis* 64
Fluctuations of Insect Populations 64
Pyrethrum and Rotenone as Insecticides 71, 84
A new Technique for Testing proposed Contact Insecticides 74
Fumigants in the Control of Pests (*Review*) 84
A short guide to Tree Fumigation (*Review*) 84
Properties of Tar Distillates for Orchard Spraying 85
The Determination of Particle Sizes in Lead Arsenate Sprays 87
Determination of Oil on *Citrus* after Spraying 89
Gases for increasing the Toxicity of HCN 90
An efficient Spray-tank Agitator 96
The Mechanism of Absorption of Sodium Fluoride by Cockroaches ... 100
The Synonymy and Systematic Position of *Phorocera silvestris* 107
A Discussion of Pests of Stored Products 110
The Female Genital System of *Dasyneura leguminicola* (*Title only*) ... 111
Outbreaks of Insect Pests and their Causes (*Title only*) 111
New Genera and Species of Aphids (*Title only*) 111
The Embryonic Development of Viviparous Aphids (*Title only*) 111
The Leaf-mines caused by Insects on Apple and Pear (*Title only*) 111
A Synopsis of Maple Leaf-mines (*Title only*) 111
The Identity of the Coccids described by Bouché (*Title only*) 111

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE
by the South Essex Recorders, Ltd., High Road, Ilford.

(101) Wt. P2821/3567 1700 2/34 S.E.R. Ltd. Gp. 353.